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GENERAL NEWS SECTION 1139

THIS is the day of specifics. We have several dozen varieties of specifics in our national pharmacy, and we are firmly convinced that if we can only pick out the correct number and apply it to our malady a cure is certain. President Taft has suddenly discovered that the trouble with our cost of living is to be found in the series of distributing agencies that lie concealed along the pathway of the product on its way from producer to consumer, each of which levies its tribute before permitting further progress. The president has not only discovered the disease, but has promptly picked out the specific and proposes at once to apply it. His specific is the parcels post. Create a new agency for the transportation of parcels directly between producer and consumer, and the thing is done. But has the president considered that we have agencies now in the express companies whose service, except for long distances and the very lightest packages, is cheaper than that of the parcels post would be under any rate proposed in any bill thus far submitted? Has he considered that the mail order houses at present encourage the assembling of orders for shipment by freight? Has he taken into account the extent to which people prefer to "shop," to inspect and handle the goods before purchasing, and that this preference applies to everything they buy except those standardized articles which are ordinarily shipped in large quantities and in heavy packages that are beyond the reach of the parcels post? Are we going into the political patent medicine business? And if so, are we not liable to have about the same degree of effecting cure as the real patent medicine venders have, and no more?

BULLETIN No. 21 of the Bureau of Railway Economics, which was printed in the *Railway Age Gazette* last week, demonstrates what will be surprising only to those not familiar with the situation; namely, that the total cost of transportation on the Erie canal is greater than on the railways, and that the expenditure in constructing and improving the Erie canal up to the year 1905 amounted to far more per mile than the cost per mile of providing the roadbed, buildings, locomotives and cars of most of the railways of this country. The bulletin is a temperate and careful exposition of the comparative costs of transportation on the Erie canal and by rail. Discussion of collateral phases of such a comparison would have brought out some points discreditable to the state of New York. Notwithstanding that the canal was constructed and is maintained at the expense of the state, tolls for its use not having been collected for its use since 1882, the state does not require uniformity in or publicity of the rates charged by the boatmen for the traffic which they carry. On the contrary, they are allowed to charge what they will and to vary their charges between one shipper and another. The state of New York, therefore, is guilty of the immorality of permitting on a means of transportation which it owns the very practices which have been widely condemned on the part of the railways, and for the prevention of which laws have been passed and commissions established. Although exact and detailed reports of tonnage are required from the railways, no reports of traffic on the canal are required, the estimates of tonnage given in the bulletin having been arrived at through laborious research. The boatmen on the canal derive an uncertain living during the period when it is open, which does not average as much as two-thirds of the year. Railway employees, on the other hand, are a very well paid class of men who for the most part have regular employment throughout the year. This study is of the Erie canal as it stands today. It remains to be seen whether the new barge canal will justify the expenditure being made on it. The $100,000,000 already voted for its construction and the additional $19,000,000 needed for terminals recall the remark of a former president of the New York Central Lines to the effect that if the state of New York would place in his hands the appropriation necessary to reconstruct the Erie canal he would agree to build a new four track railway for its entire length with part of the funds, and that the remainder placed at interest would yield enough to pay for its operation.

A NEW ORLEANS despatch tells of the indictment on 10 counts by the federal grand jury of a shipper charged with false valuations by which he obtained a lower freight rate. The incident directs attention to that under-billing of consignments from which railways are the more likely to suffer because detection is not only difficult but unpleasant. Detection involves, in the first place, the clues upon which suspicion is based and, next, the obtaining of evidence in such ways, for example, as the opening of the boxes of the consignor—not a pleasant task, especially if he happens to be an important shipper. Then there is that other fraud, underweighing by the consignor. But their detection is easier and the responsibility really rests upon the railway company itself if its agents—as in some cases—do not insist upon re-weighing but accept the consignor's figures. In both these cases—under-classification and under-weight—involving deliberate fraud, the provisions of the Interstate Commerce law are worth attention. The statute provides that any persons or officer or agent of a corporation who directly or indirectly "by false billing, false classification, false weighing, false representation of the contents of the package or the substance of the property, false report of weight, false statement or any other device or means," obtains or attempts to obtain transportation of such property at less than the regular rates, shall be guilty of fraud and incur a penalty not exceeding $5,000 fine or two years' imprisonment, or both, the crime being knowingly committed. The same penalty applies to under-valuation, and, it may be noted, is exactly the penalty incurred by a common carrier or its officers or agent for illegal rebates. The Interstate Commerce law treats carrier and consignor alike, and the former—whatever may be its timidity in calling upon the commission's detective agents—cannot plead that the statute does not give it a sufficient weapon. But with efficiency and insight at the freight house, and the shipper's realization of them, it does not seem as though the weapon need be often used.

BECAUSE the Commerce Court has set aside some important orders of the Interstate Commerce Commission a movement has been started, it is reported, by certain members of Congress, to abolish the court; in other words, in accordance with the most up-to-date political notions, it is proposed to "recall" the court. The court was established mainly to test the soundness of the reports and orders of the commission by applying to them the law as the court understood it. The criticism of it implies that those making it believe that they and the Interstate Commerce Commission know what the law means better than the court does, and that the commission is more apt than the court correctly to apply it. Undoubtedly, if this assumption is correct, the court ought to be abolished. But those familiar with the past history of the commission will recall that its experience with the Commerce Court is precisely similar to its previous experience with the circuit and the supreme courts. They repeatedly reversed it before the Commerce Court was established. The Commerce Court contains a former chairman of the Interstate Commerce Commission and some experienced former circuit judges. Furthermore, the commission, as an administrative body, exercises executive authority, and, like practically all such bodies, has throughout its career shown a tendency to desire to exercise more power than it has been given and therefore to assume that it has all the power it wishes to exercise. In view of these facts most observers are apt to think that the court's interpretation and application of the law is more likely to be right than the commission's. As to whether the existence of the court shall be terminated that is a matter about which the railways need give themselves little concern. There is an advantage to both shippers and railways in having all appeals from the commission in rate cases made to one court; this results in the decisions being consistent. Furthermore, the Commerce Court can expedite rate cases more than could the circuit courts. On the other hand, as to the way in which the law shall be interpreted, judged by past experience the circuit courts, to which appeals in rate cases would be restored, would overrule the commission just as often in proportion as the Commerce Court is doing. One argument made for the creation of the Commerce Court was that it would be more expert in dealing with matters of this sort; but most of the life was taken out of that argument by the limitation of the terms of the judges on the Commerce Court to five years. They are really circuit judges appointed for life, and temporarily assigned to the Commerce Court; and if the court were abolished they would be transferred to the circuit bench, where they would go on deciding rate cases much as they are doing now. There never was a more bizarre and probably illegal order than that issued by the commission in the transcontinental freight rate cases; and the fact that it was the action of the Commerce Court in restraining the enforcement of this order that started the agitation against the court shows that the agitation is an outgrowth of the new bureaucratic theory that administrative officials should be allowed to do their own interpreting of the laws under which they act and which they enforce, and that when the courts interfere with them they engage in more troublesome meddling. That theory can never prevail in the United States under our present form of government, no matter to what courts appeals lie from orders of administrative bodies.

DENVER'S RATE COMPLAINT.

THE Denver Chamber of Commerce, moved thereto by a furious agitation conducted by one of the local newspapers, has announced its intention to complain to the Interstate Commerce Commission because the wicked railways charge higher rates between Galveston and Denver than they do between New York and Chicago and between Newport News and St. Louis—the distances between these various points being substantially the same. The fact that business men, who in most things are level-headed, can be pushed by the yellow, pink and green school of journalism into making such a complaint shows how foolishly and unjustly people will act sometimes when not guided by the intelligence and common sense that enable them to succeed in their own businesses.

While the distances between New York and Chicago, and between Newport News and St. Louis, are about the same as that between Galveston and Denver, there is no similarity whatever between the conditions under which traffic is handled between these points. The railways operating between New York and Chicago have from two to six times as much traffic per mile, and the railways operating between Newport News and St. Louis likewise have several times as much traffic per mile, as have the roads from Galveston to Denver. Therefore, if the same rates were applied between Galveston and Denver as between the other points named, the lines from Galveston to Denver would be thrown into irretrievable insolvency. The average rate per ton per mile on the Colorado & Southern lines, for example, is 9.6 mills. If the class rates between Galveston and Denver ought to be the same as the class rates between Newport News and St. Louis, then, by the same token, all other rates should be. But if the Colorado & Southern lines received only an average rate of 5.77 mills per ton per mile, which is the average received by the Baltimore & Ohio, forming part of the short line from Newport News to St. Louis, the Colorado & Southern Lines' net operating income would be reduced to $608,830. This would be $2,056,178 less than enough to pay the annual interest on their funded debt.

The theory on which the Denver critics of the railways are proceeding is that rates per ton per mile between all points in the United States should be the same. From this assumption it follows just as logically that the rates between New York and Chicago and between Newport News and St. Louis should be raised to the same level as between Galveston and Denver as it does that the rates between Galveston and Denver should be reduced to the same basis as those between New York and Chicago and between Newport News and St. Louis. Such a silly way of reasoning might, therefore, lead to the conclusion that shippers on the New York Central, the Lake Shore, the Balti-

more & Ohio and the Chesapeake & Ohio are getting their transportation very much too cheaply. These shippers would say, however, that if the rates they pay were raised to the same basis as those between Galveston and Denver the roads between New York and Chicago, and between Newport News and St. Louis, would make too much money. But if the effect of an advance in rates on the earnings of railways is to be considered in determining whether it would be reasonable, why should not the effect on earnings of a reduction be given weight in considering whether it would be reasonable?

The complainants at Denver take the course so often followed by those who criticize railway rates either without fairness or without knowledge, and select for comparison with their own rates, not rates in other localities similarly situated, but the lowest rates that they can find anywhere. It is well known that between Chicago and New York the class rates are the lowest and the traffic the heaviest in the United States. Let us compare Denver's rates with some fixed by the Interstate Commerce Commission where conditions are more similar. The distance from Galveston to Denver is approximately 1,000 miles and the first class rate is $1.80. The distance from Chicago to Denver is approximately 1,000 miles, and the Interstate Commerce Commission, in the case of Kindel versus New York, New Haven & Hartford, fixed $1.80 as a reasonable first class rate from Chicago to Denver. The distance from Omaha to Ogden is 1,000 miles and the commission in the Salt Lake rate case held that a reasonable first class rate for this haul would be $1.90. The traffic affected by both of these decisions is denser than that between Galveston and Denver. Therefore, either the existing rates from Galveston to Denver are reasonable, or the Interstate Commerce Commission's decision in the Kindel and Salt Lake cases were wrong. Unless the commission shall deliberately choose to stultify itself in respect to its recent decisions in these cases, the complainants in this new Denver case cannot reasonably hope to be successful in prosecuting it. But it will be good advertising for the newspaper that started the agitation!

ABOLISH THE PRESENT GIVING.

IT is a widespread custom for the representatives of concerns that sell goods to give presents at this season to the representatives of concerns that buy them. Perhaps no class of persons spends more money this way than is spent by those connected with railway supply concerns for gifts for railway officers whose positions give them influence in determining what, and where, supplies and equipment shall be bought. The entire custom referred to is essentially bad. It is no better as it grows out of and affects the relations of those connected with railway supply houses and railways than as it obtains elsewhere. It ought, so far as it is associated with the supply and the railway business, to be destroyed; and there will never be a better time to begin than in the present holiday season.

The practice has prevailed so long and generally that many who have year after year been the donors or recipients may regard condemnation of it as hypercritical, or even hypocritical. If those who think thus will consider carefully its purposes and effects most of them will see wherein the vice of it lies. Is the giving, by an officer or salesman of a supply concern, of an expensive present to a railway officer, or one of his family, solely an act of personal courtesy and generosity which is intended to express merely the friendship of the giver for the recipient? The answer is, that the price of the gift almost invariably appears in the expense account that the giver turns in to his company. This would not be so if it were purely a personal matter. The reason why the supply concern ultimately pays for the present is that it expects thereby to gain something. Again, almost invariably when the railway officer leaves railway service he ceases also to be the recipient of gifts from supply men. These facts can mean only one thing, viz., that the supply house which foots the bill expects to be enabled thereby to sell more goods to the railway whose officer receives the gift, or to sell them at a higher price, or to sell poorer goods than it otherwise could.

Now, one of two results does ensue. Either the expenditure for the presents has its desired and intended effect, or it does not have. If it does not have it, the supply concern's money is wasted. If it does have it, the railway loses either because it does not get the kind of goods that ought to be bought for it, or because it does not get them at as low a price as it ought to. In other words, the money spent has finally to come out of somebody's pocket. That somebody is either the supply house or the railway. Generally, in the long run, it comes out of the pocket either of some individual railway or of the railways as a whole. If the most favorable view could be taken—viz., that purchases for railways were never influenced by this giving of presents—still, it would remain true that in the long run the cost of practically all of the expenditures for them would be added to railway operating expenses. As a matter of fact, no one who is familiar with the facts can entertain this most favorable and charitable view. The giving of presents by the supply houses does in many cases influence purchases, and in a bad way.

The worst feature of the matter is that such gift-giving is sometimes the precursor or cloak of theft or graft. There have been known cases where the prices of expensive presents to railway men have been itemized in expense accounts presented to supply concerns by their men, when the railway men never received or heard of them. Again, in some cases where grafting in railways has been uncovered, investigation has disclosed that it began by supply houses giving railway officers comparatively small presents in the form, perhaps, of stock in their concerns. The sensation of thus getting "easy money" was the beginning of the downfall of the railway men concerned. They did not intend at first to benefit themselves at the expense of their companies; but after they had taken the first step in that direction they were unable to retrace it or to resist the temptation to go farther. Of course, when persons in subordinate railway positions know their superiors are accepting gifts from supply houses the subordinates are apt to yield to, or even to invite, similar temptation. And the superior officer in this case cannot exercise the sort of supervision over his subordinates that his duty and the welfare of the road require.

Doubtless, most supply men and railway men would like to see abolished this and all other customs which tend, or may be suspected of tending, to interfere with their selling and buying goods absolutely on their merits. The situation is similar to that which existed in the days of railway rebating. Because some railways persisted in giving rebates and some shippers in accepting them, all felt that they must give and accept them, although all saw that rebating was a vicious abuse.

A beginning ought to be made right now to abolish the giving of gifts by supply concerns to railway officers. It would be a wise move if the president of each supply concern would issue an order forbidding those connected with it from giving presents, this holiday season or in future, to those directly or indirectly concerned with railway purchases; and if the president of every railway would forbid all directly or indirectly concerned with purchases from receiving presents from supply houses or those connected with them. If the supply concerns will not stop offering presents, railway men ought to reject them. The custom in question is not only intrinsically bad, but there is a danger connected with it of which most people do not think. It may invite malicious and exaggerated newspaper or magazine attacks at any time which would do everybody connected with supply houses and railways harm. One of the vital mistakes that the railways repeatedly have made has been to do nothing to correct abuses which everybody recognizes as such until attacks and movements for their abolition originated in hostile sources. Warned by the the experience of the past, such mistakes ought to be avoided in future.

PROPOSED POSTAL CAR SPECIFICATIONS.

THE *Railway Age Gazette* of November 24 published the proposed specification for the construction of all-steel and steel underframe full postal cars, which has been sent out to the railways for examination and suggestions, and will be discussed by a committee of railway men and a committee from the post office department at Washington, D. C., on December 5. The specification is intended as a ground work on which to build up the final standard plans. In its present form it may be regarded as recommended practice, representing as it does the best judgment of the railway, mechanical and mail traffic officers, and the individual builders of steel passenger equipment. It may be said, also, that it represents the various types of steel underframes which the car builders regard as their particular designs. These different types, as constructed heretofore, are not equally efficient as to strength and stiffness; nor are they equally economical in cost of construction and repairs; and a strict compliance with the proposed specification, especially with its requirement for stiffness, would call for considerable modification in many of the earlier designs for steel cars.

Something has been learned from the behavior of different types of underframes in wrecks, but even here true and impartial interpretation of results is difficult to obtain. One important lesson in steel car construction has been learned in this connection, and that concerns the relative importance of the section of the center sills to the complete system of longitudinal members in the underframe. A considerable change has taken place in the views of engineers and car builders as to this matter. The committee of the M. C. B. Association on steel passenger cars which reported in 1908 had been instructed to recommend, among other things, a standard sectional area for center sills and cover plates. It found that the center sill area for one type of car was 10.66 sq. in.; for another 18.52 sq. in., and for a third 50 sq. in.; and that on account of the differences in design no standard section for center sills could be recommended. It was evidently the general opinion at that time that the center sills should have a sufficient area to resist the entire buffing shock, but the improvements in end sill construction have been so pronounced that the postal car committee is able confidently to recommend a specification for buffing resistance which specifically includes all continuous longitudinal underframe members below the floor level. It is, however, distinctly provided that such members must be so tied together as to act in unison. This requirement insures a more substantial structure than is found in the ordinary steel underframe. The single paragraph of seven lines relating to buffing is probably the most important part of the whole specification, as it helps to explain why the different types of underframes are accepted, and makes clear that hereafter the center sills and cover plates are not to be regarded as the only members resisting end shock.

While the requirement that the maximum end shock due to buffing shall be assumed as a static load of 400,000 lbs. applied horizontally at the resultant line of the forces acting at the center lines of the buffing mechanism and draft gear, has been adopted by some railways and car companies, it has not become an established standard, and the adoption of this figure by the federal authorities as a measure of the strength and stiffness of postal cars would have a good effect on passenger car design in general. While 400,000 lbs. compressive static load may be regarded as a minimum figure, it is based on the specified stresses, which are also low. A figure as high as 500,000 lbs. has been recommended by good authority and used by some builders who assume the elastic limit of the steel as 30,000 lbs.

The buffing figure recommended in the preliminary specification should insure ample strength and, if adopted, will help largely to prevent the constant increase in weight of passenger equipment which is found in current practice. While the postal authorities may adopt rigid standards for the interior arrangement, the fixtures and fittings, the proposed specification for the construction of the car body is based on general requirements, which are so intelligent and practical, and which mark such an advance over present practise, that it will doubtless be approved with little modification. In this way the reasonable demands of the government in its efforts to safeguard the postal clerks and make them comfortable will be fully satisfied, while no serious burdens will be laid on the railways, by involving them in excessive and useless expenditures, or by compelling them to abandon many of their individual standards or the essentials of established practice.

UNION PACIFIC.

AFTER two annual reports in which operations of the Union Pacific as a banking company were quite uninteresting as compared with its railway operations, it is especially necessary this year to keep clearly in mind the distinction between the two forms of activity of the company. This is so because at the end of the 1911 fiscal year the company shows an increase of $71,120,000 in its assets, which is very largely the result of banking operations and not of railway operations. It would possibly be more accurate to say that its being shown *this* year is the result of a change in banking methods rather than the result of banking operations.

From its railway operations the company—and by the company we mean the Union Pacific Railroad, the Oregon Short Line and the Oregon-Washington Railroad & Navigation Co.—earned net, after the payment of fixed charges and rentals, $21,580,000 in 1911, as compared with $25,990,000 in 1910. Four-per cent. dividends were paid on the Union Pacific preferred stock and 6 per cent. on the common, leaving a surplus from transportation operations of $4,600,000 in 1911 and $8,990,000 in 1910. The additional 4-per cent. dividends paid on the Union Pacific common stock comes from the company's revenue from investment banking operations. These banking operations and the increase in assets will be discussed later.

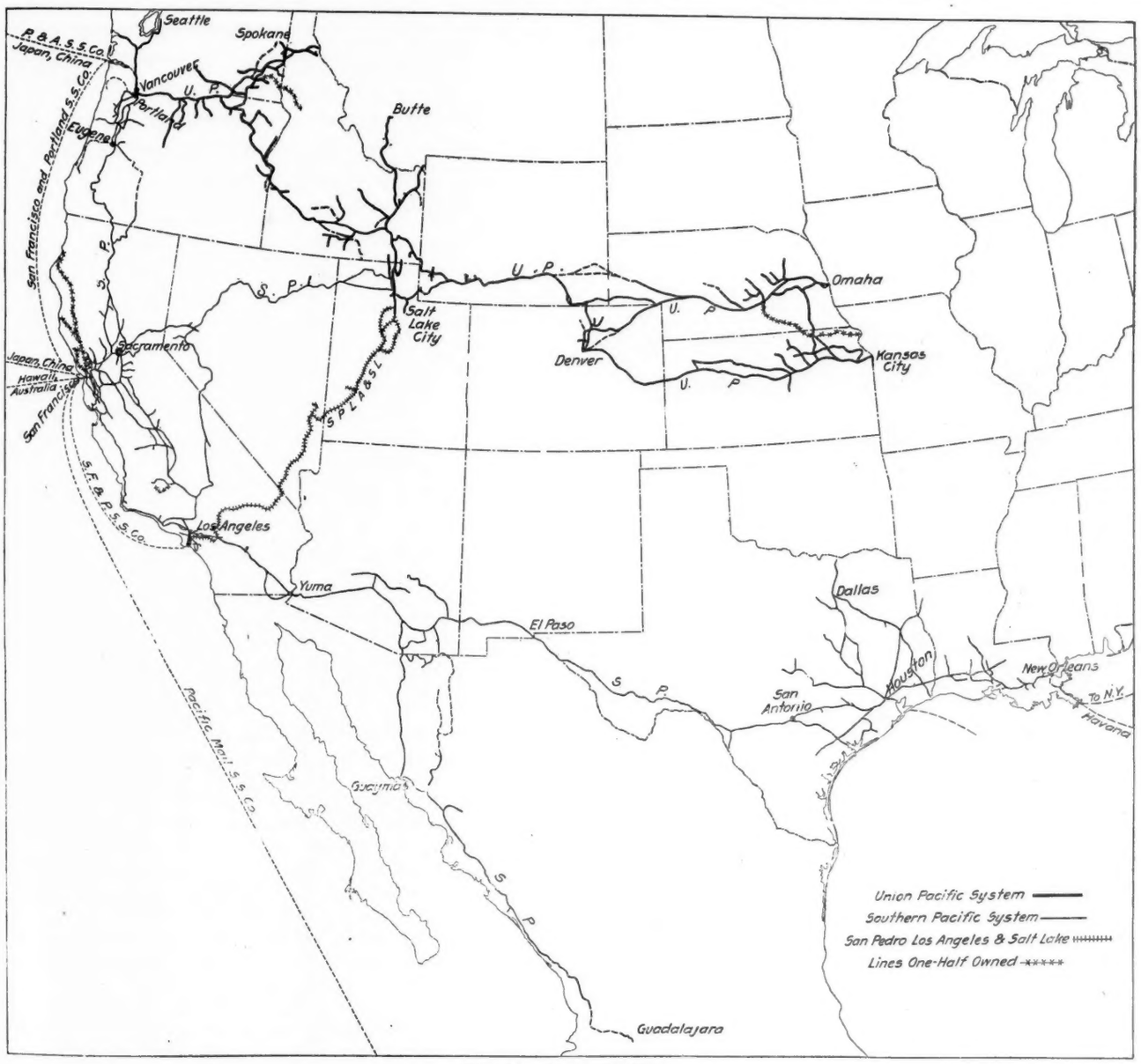
The Union Pacific's plant consists of 6,678 miles of railway. Its roadway and track are in some respects the best piece of railway property in the West. It is largely main line with a heavy density of traffic, ballasted from Omaha to Ogden with Sherman Hill disintegrated granite; and, of the 4,425 miles of main line, 1,621 miles are laid with 90-lb. rail and 1,479 with 80-lb. rail. Forty-two per cent. of the track, exclusive of sidings but including branch lines, is laid with 90 and 80-lb. rail. Nearly all of the line between Omaha and Cheyenne is double tracked, and there are long stretches of double track from Cheyenne west to Ogden. The road needs to be double tracked all the way from Omaha to Ogden, and the appropriation for doing the necessary additional double tracking has been made and work is in progress.

The Union Pacific's freight density (commercial and company freight carried one mile per mile of road) is 1,100,131. This is the figure for 1911, and is less by 4.80 per cent. than the density in 1910, due to a falling off in company freight traffic. In addition to this very heavy freight density, the Union Pacific carried last year 139,587 passengers one mile per mile of road, which was less by 8.34 per cent. than the passenger density in the year before. Moreover, a large part of the Union Pacific's passenger business is high class through business that demands a fast schedule and a minimum of delay.

The character of the freight traffic is diversified, but a large proportion of it is dependent on agriculture. In 1911, 11.98 per cent. of the total tonnage was furnished by grain, and the tonnage of all products of agriculture aggregated 24.31 per cent. of the total tonnage. This compares with 23.55 per cent. of total tonnage furnished by products of agriculture in 1910. Live stock and animal products furnished 6.55 per cent. of total tonnage in 1911 and 6.42 per cent. in 1910; products of mines furnished 33.81 per cent. last year and 33.89 per cent. the year before; products of forests furnished 14.51 per cent. last year and 14.31 per cent. the year before; manufactures furnished 13.33 per cent.

last year and 13.93 per cent. the year before; merchandise furnished 5.38 per cent. last year and 5.47 per cent. the year before. The total tonnage of revenue freight carried in 1911 was 15,550,000, and in 1910, 15,310,000. These figures include in both years company freight for which a charge is made. In 1911 this company freight for construction and new lines for which a charge is made amounted to 740,000 tons. The average haul last year was 392 miles, or just the same as the year before. The average receipts per ton per mile, however, were 1.003 cents, as compared with 1.024 cents, a reduction of 2.05 per cent.

The Union Pacific is a road that, partly from necessity and partly from a matter of policy, has especially endeavored to get its freight over the line on a fast schedule and has therefore not laid the same stress on heavy train loading that the Hill lines have; nevertheless, the Union Pacific's train load is a very creditable figure. Comparisons between 1910 and 1911 of revenue freight train load are not available because of the change of method in shown company freight on which there is a charge. In 1911 the revenue train load (excluding company freight on which a charge is made) was 441 tons, as compared with 452 tons (including company freight on which there was a charge.) The train load last year was 499 tons for all freight, including company freight, both free and that for which a charge was made. This is an increase of 11.12 tons, or 2.28 per cent., over the year before. The difference in policy as between the Hill lines and the Harriman lines in regard to the importance attached to heavy train loads is quite well illustrated by the difference in construction of the Des Chutes line of the Oregon-Washington Railroad & Navigation Company and the Oregon Trunk, of the Hill lines, the Hill lines grade being much the lower. Traffic figures would probably show that the Hill lines have a considerably heavier average train load; but on the other hand, the Des Chutes cost a much smaller amount per mile to build than the corresponding mileage cost of the Hill lines.



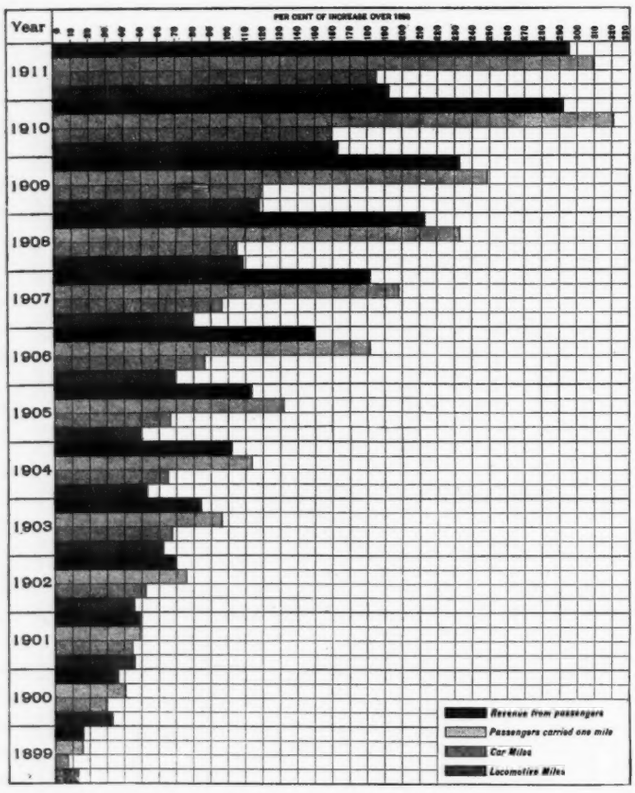
The Harriman Pacifics.

With total company and revenue ton mileage greater by 0.98 per cent. in 1911 than in 1910 and passenger mileage less by 2.78 per cent., and with average mileage of railway operated greater by 6.07 per cent., the Union Pacific and auxiliary companies had a locomotive mileage for freight and mixed trains less by 1.27 per cent. in 1911 than in 1910, and a locomotive mileage for passenger and mixed trains greater by 11.04 per cent. in 1911 than in 1910. It is interesting to note that the mileage of gasolene

motor cars aggregated 627,000 miles in 1911, or 3.95 per cent. of the total revenue passenger train mileage. The percentage of loaded freight car mileage to total freight car mileage was 74.93 in 1911, as against 76.30 in 1910. Transportation expenses as a whole amounted to $23,990,000, an increase of 8.03 per cent. over 1910. This increase is due in part to an increase of $691,000, or 9.76 per cent., in the cost of fuel for locomotives, bringing the total cost in 1911 up to $7,780,000. Last year transportation, traffic and general expenses consumed 32.40 per cent. of gross revenue of rail lines, as against 29.55 per cent. the year before; and maintenance of way and equipment cost 22.54 per cent. of gross in 1911 and 21.46 per cent. in 1910.

The average cost of maintenance of way and structures per mile of all main track, which includes first and additional main track is $1,431, or 1.84 per cent. less than was spent in 1910. Up to January, or later, on most of the lines the full track forces were at work, but since that time there has been a considerable cut in track forces, due to a necessity to cut down expenses. The Union Pacific is in such shape physically that it can cut its track forces to a mere skeleton of a force for a few months without any serious detriment to the property.

Maintenance of equipment cost $9,210,000 last year, an increase of 1.48 per cent. over the year before, due almost entirely to an increase in the cost of maintenance of locomotives. The average cost of repairs, excluding renewals and depreciation, per locomotive was $3,708 in 1911 and $3,593 in 1910.

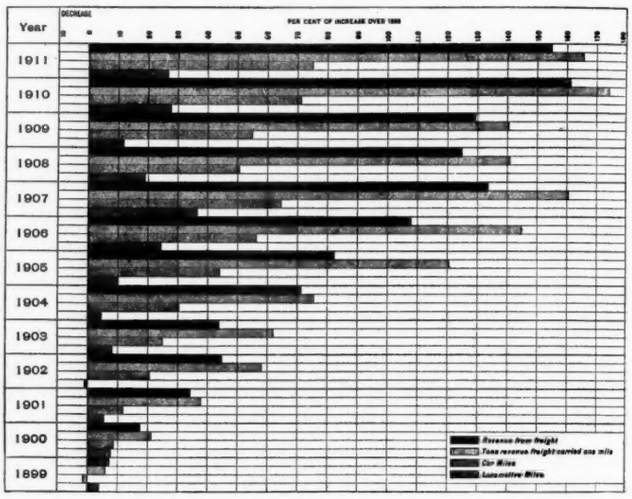


Passenger Service and Traffic.

Showing by years the per cent. of increase over the year ended June 30, 1898, in the gross revenue from the transportation of passengers, the number of passengers carried one mile, and the number of miles run by cars and locomotives in passenger train service.

In 1911 there was a net total of $39,300,000, other than for stocks and bonds of outside companies, charged to capital account. Of this amount, $5,690,000 was spent for extensions and branches; $12,300,000 for construction, prior to the fiscal year ended June 30, 1911, on railways acquired and for railways now carried on the balance sheet as property investment heretofore carried as stocks and bonds owned; $7,770,000 for roadway and track, including $3,690,000 spent for additional main track; $2,160,000 for buildings and structures, which includes $814,000 for buildings for general service; and $9,350,000 for additional equipment.

It is interesting to note the extent to which the Union Pacific has added to its equipment during the past year—a year in which there was a somewhat smaller traffic to be moved. At the end of 1910 the company had 1,134 locomotives, with an average weight of 87.82 tons; at the end of 1911 the company had 1,330 locomotives, with an average weight of 88.74 tons. Of the locomotives in service at the end of 1910, 28.93 per cent. were in



Freight Service and Traffic.

Showing by years the per cent. of increase over the year ended June 30, 1898, in the gross revenue from the transportaiton of commercial freight, the number of tons of commercial freight carried one mile, and the number of miles run by cars and locomotives in freight train service.

thorough order and 41.71 per cent. in good order; while in 1911 34.14 per cent. were in thorough order and 41.58 per cent. in good order. At the end of 1910, 18.34 per cent. of the locomotives required repairs and 11.02 per cent. additional were in shop, while in 1911, 15.49 per cent. required repairs and 8.79 per cent. were in shop. At the end of 1910 the company had 825 passenger train cars, and at the end of 1911, 959 passenger trains cars. At the end of 1910 the company had 26,043 freight cars, with an average capacity of 39.59 tons; at the end of 1911 the total number of freight cars was 28,955, and they had an average capacity of 41.60 tons. Certainly an average capacity of over 40 tons per freight car shows a policy of condemning and weeding out obsolete equipment, that is a good deal sounder policy of railroading than any theoretical charge of an arbitrary sum for depreciation, which charge the Union Pacific does not make.

When we come to the study of the balance sheet of the Union Pacific Railroad and auxiliary companies we are compelled to a study of the banking operations of the company as well as its railway operations. The balance sheet at the end of 1911 shows a total book value of $259,830,000 of bonds and stock owned (excluding the companies own securities). The Union Pacific and auxiliary companies owned at the end of 1911 $150,030,000 par value of their own stocks, which is more by $83,420,000 than was owned at the end of 1910. No part of these stocks is pledged. These companies at the end of 1911 owned $94,050,000 of their own bonds, an increase of $8,570,000 over the year before, and of these bonds no part is pledged. The total stocks and bonds carried on the balance sheet and mentioned above include $41,920,000 *par* stocks of other companies, of which only $99,000 are pledged. Stocks of these companies are held probably not so much as an investment of funds but for the advantages that may accrue to the Union Pacific as a railway company. To illustrate, the company owns half of the total outstanding stock of the Pacific Fruit Express, the other half being owned by the Southern Pacific.

In addition to these holdings for railway purposes, the Union Pacific and the Oregon Short Line own a total *par* value of $228,900,000 stocks of other railway companies, of which $133,460,000 stocks are deposited under the Oregon Short Line refunding mortgage. This is the par value. These stocks cost $223,796,000, and on June 30, 1911, their market value was about $267,000,000. These investment stocks, as they are called, include: Baltimore & Ohio; Chicago & Alton; Chicago & North Western; Chicago, Milwauke & St. Paul; Illinois Central; New York Central & Hudson River; Northern Securities' stubs; Railroad Securities Company; and, of course, control of the Southern Pacific, held not only for investment but for railway purposes. In addition to this, the Union Pacific and auxiliary companies own $36,280,000 face value bonds of other companies, of which $28,820,000 are pledged. The Union Pacific originally bought its investment stocks partly through its attempt to gain control of the Chicago, Burlington & Quincy with the consequent formation of the Northern Securities Company and its subsequent dissolution and distribution of assets. It was partly also through a desire of E. H. Harriman to gain a voice in the management of such companies as the Baltimore & Ohio and the New York Central.

Heretofore, when blocks of these investment stocks were sold the profit from the sale was credited to the total investment account. This year, however, the method has been changed and past profits have been credited to profit and loss. It is this taking into profit and loss account of past profits that has made this year's operation show an increase of $71,000,000 in the assets. If the Union Pacific were not a railway company but a company run only in the interests of stockholders and subject only to their regulation, it would be more conservative to continue the past policy of crediting profit on investment stocks toward writing down the valuation at which the remaining stocks were carried on the books. But the Union Pacific, it is a railway company facing the possibility of at any time having to justify its rates by bringing forward its own valuation of its property. The *Wall Street Journal,* in a very able study of the Union Pacific's handling of its investment stocks account, has suggested that the present "writing up"* of the profit and loss account is due to a farsighted belief on the part of the management that at some future time the railways may be taken over by the government. This may be perfectly true, but it is hardly necessary to go quite so far into the future to find at least a very plausible and convincingly sound reason why the account should be treated at it is.

If the Hadley commission should recommend the regulation by the government of the issues of securities and even, possibly, a physical valuation of railways, the railway companies would have to stand on their own bookkeeping. It is quite possible that unless their books showed all their profits the "written off" profits might not be admited as evidence of value.

The Interstate Commerce Commission has indicated clearly by its rules for charges for additions and betterments its theories as to crediting to surplus or cost of property everything that is not spent for upkeep. The Union Pacific's policy in transferring the profits on the sale of its stock from a "writing down" of the valuation at which they are carried to a "writing up" of the profit and loss account appears analogous to charging to capital account all additions and betterments whether or not necessitated by the general raising of the standards of railway property. It might be recommended that on the same theory the company should not carry these investment stocks on its balance sheet at cost, but should revalue them each year according to market prices so as to show any loss that might be incurred. This, however, would actually be more misleading than to carry them at cost until they are sold, because a valuation of these stocks taken at an arbitrarily fixed time would not indicate what the value of the stocks were if sold by a competent management under market conditions which they could themselves choose.

At the end of 1911 the Union Pacific had on hand $12,170,000 cash, or $3,090,000 more than at the end of 1910, and had demand loans due from the Southern Pacific of $20,000,000, or $9,100,000 more than at the end of 1910. It also has demand loans and time deposits amounting to $28,900,000. On the other hand, at the end of last year total current liabilities, including coupons due July 1 and dividends payable July 1 and October 2, amounted to $25,220,000, an increase of $1,440,000.

The table shows the principal figures for 1911 and 1910:

	1911.	1910.
Average mileage operated	6,678	6,296
Freight revenue	$59,964,364	$61,479,680
Passenger revenue	20,981,405	20,814,820
*Total operating revenue	88,983,108	90,228,092
Maint. of way and structures	10,445,203	9,915,482
Maint. of equipment	9,208,725	9,074,653
Traffic	2,021,492	1,985,018
Transportation	23,991,335	22,208,262
*Total operating expenses	49,807,834	46,938,909
Taxes	3,464,147	3,264,347
Operating income	35,711,127	40,024,835
Interest and rentals	14,131,937	14,031,196
Dividends payable from railway operation	16,977,487	17,004,320
Income from investment operations	18,296,571	19,512,051
Dividends (4 per cent. additional on the common stock, making a total of 10 per cent. paid)	8,663,829	8,681,546
Total surplus after the payment of dividends	14,334,446	19,819,825

*Including outside operations.

NEW BOOKS.

Problems in Railway Regulation. By Henry S. Haines. The MacMillan Company, New York. Cloth. 5¼x8¼. 582 pages. Price, $1.75.

Mr. Haines has developed in "Problems in Railway Regulation" the treatment of subjects dealt with in his "American Railway Management," "Restrictive Railway Regulation" and "Railways as Public Servants." It is largely an application of views previously expressed by him to new phases of regulation; and that there is a good deal of new matter in the book is as much a tribute to the resourcefulness of the regulating authorities as of the author.

After tracing historically the development of the American railway system and of the policy of regulation, he discusses specifically the questions of regulating, incorporation, finance, construction, operation and traffic. He gives one chapter to "Problems of Capital and Labor" and the concluding one to "Tendency of Government Regulation."

Having been a railway operating officer, he is most instructive and interesting in the discussion of regulation of operation. His chapter on this subject brings home rather forcibly the fact that few of us are apt to give enough credit to the federal government for the results it has gained in the regulation of operation. He shows that much good has been done by the Safety Appliances law; by the co-operation between the Interstate Commerce Commission and the American Railway Association in framing and carrying out regulations for the handling of explosives; by similar co-operation between the National Association of Railway Commissioners, the Interstate Commerce Commission and the roads in formulating and adopting the Uniform Code of Demurrage rules; and by like co-operation between the employees, the railways and committees of Congress in drafting the law for the inspection of locomotive boilers. His narrative and comment bring out forcibly that no wise and salutary regulation of operation ever has been adopted except when railway men and the regulating authorities did co-operate in working out a policy; and that the more regulatory laws or orders have tried to prescribe in detail what operating methods railways should use, the more complete failures they have been.

Mr. Haines is an advocate of the value-of-the-service principle in rate-making and shows how impracticable it is to ascertain the costs of different services accurately and how impracticable it would be to base rates on these costs even if ascertainable. He believes, like most students of the subject, that strict limitation of railway profits will prevent adequate railway construction and improvements, which will result in great public harm.

* "Writing up" is used in the bookkeeping sense!

Letters to the Editor.

OLIVER ROWE, INSPECTOR—A TRIBUTE.

Portland, Ore., November 17, 1911.

To the Editor of the Railway Age Gazette:

Sad is the news from Cheyenne, Wyo. Dead as a result of injuries received in a collision at Rock River is Oliver Rowe, inspector of transportation of the Harriman Lines. Inscrutable are the ways of Providence. Ironical are the flings of fate. The faithful, tireless inspector, who by hundreds and hundreds of efficiency tests, who by intelligent checking night and day, had done more than his share to make travel safe, is himself the victim. A suddenly dazed brakeman throws the wrong switch in the face of a fast-approaching train and sets at naught years of official effort, millions of dollars of expenditure for safety appliances.

The life and death of this unassuming little man contain a lesson for all railway officials and employees. The fairies at his cradle denied him the graces, but they bestowed the stronger gifts of honesty, industry, coolness and patience. Devotion to duty was the dominant note in his character, so dominant that I am sure every one of us always worked a little harder after being with him. Brought up as an operator and train despatcher on the Houston & Texas Central, he became its division superintendent at Ennis. In later years, his closest home tie broken by death, he, as inspector of transportation, literally lived on the road. The position of an inspector is not an easy one. The burden of proof is on him to establish his sincerity as well as his capacity. So well did "Ollie" Rowe succeed in this that on most, if not all, divisions he became a welcome visitor. He had acquired unconsciously a great secret of success, the ability to subordinate himself to the work he represented. All day he would check train sheets in an office, so quietly that his presence might pass almost unnoticed. All night he would ride in a caboose or on an engine, so unobtrusively and so unostentiously that a stranger would give him little notice. Yet in all cases his reports became proverbial for their comprehensive recital of actual working conditions.

Men of his type are all too rare, and we who knew him are the better for the acquaintance. His work will live in the improved conditions that he helped to develop. D. A. D.

WANTED—MORE DISCUSSION OF THE UNIT SYSTEM.

November 11, 1911.

To the Editor of the Railway Age Gazette:

The series of letters by Major Hine, recently completed in the *Railway Age Gazette*, has been a great help and inspiration to the operating men in the trenches. Aside from the central theme of organization, the letters are filled with nuggets of homely truths, each of which assay 100 per cent. The feudal system of operation, the fallacies of the fiscal year, the unjust comparison of results by the unstable operating ratio, the lack of proper support in critical periods from the real powers, are some of the conditions that constantly confront the operating man. In our selfishness we had hoped the letters would continue indefinitely, as we all need our backbones stiffened from time to time by the reiteration of known truths.

As regards the unit system, Major Hine has proven his case. Since its adoption by the Harriman Lines, officers who said the plan was chimerical and would not work have adopted it, perhaps by another name, in toto or in part. The writer was one of the doubters, but now is humbly wearing his sackcloth and ashes. Many practical railway men are still unconvinced that the unit system is all that is claimed for it, but, nothwithstanding what the critics say, the fact remains that many of the ideas advanced are receiving practical application at the hands of the unbelievers and are working successfully.

The writer is a practical railway man with everyday duties that take him into the midst of things. As an experienced staff officer he has always striven to lead rather than to drive and has always given full consideration to the views of the men who think along different channels. As it is much easier to cling to the old than to develop the new, our gratitude is due to Major Hine for his conception of the unit system and to Mr. Kruttschnitt for his prompt recognition of its future possibilities.

Unless Major Hine can be induced to take up again the burden he has laid down, would it not be profitable to secure discussions of the merits and demerits of the system based on practical everyday operation? GENERAL SUPERINTENDENT.

AFFABILITY—EXAMPLES OF THE OPPOSITE.

Mobile, Ala., October 23, 1911.

To the Editor of the Railway Age Gazette:

I have read with interest a letter signed "FX" in your last issue on Weaknesses in Train Operation, and also your editorial on Affability as an Asset. I believe that I have succeeded in gaining the confidence of nearly all of the men on my division by mixing with them freely and making them understand that they are to hew to the line, and to be square in every respect. They must do this in order to receive any assistance from me in helping them out of any tight place. They all appear to understand that each violation of the rules will be quickly and justly handled. In our attempt to inculcate lessons of politeness we try to give concrete illustrations. It is a good idea to do this frequently.

T. B. TURNER,
Master of Trains, L. & N.

Mr. Turner quotes as follows from one of his circulars to employees:

The best possible way to win the good will and friendship of our patrons is by politeness. Be polite, no matter what happens; be polite to everybody; but reserve a special brand of charming deference for use toward older persons with whom you come in contact. Passenger trainmen have many questions asked that seem foolish, but the party asking them should be given as full and as pleasant an answer as possible. . . . I heard a patron of the road ask a conductor if his train was going to B—, and upon getting the answer "Not today," he was taken aback; and he felt hurt at such a short answer; and he remarked to me, "There is your Bureau of Information. I don't know which way B— is; have just come in from the country, and am turned around." Had the answer been "No, B— is in the other direction, and you can get a train at 9:20 p. m.," the man would have felt much better. It would not have taken five seconds to give the proper answer.

Recently a freight train moving backward came near striking a man, and one of the trainmen shouted to him, "Look out! what is the matter with you; can't you see?" The last part of the warning was superfluous and was taken as an insult; and it brought upon the trainman an arrest, followed by a fine; and he was otherwise humiliated. Would it not have been much better had he stopped after he said "Look out"? Or, if, in his haste, he spoke in a manner which was ungentlemanly, he should have added an apology. Had this been done, I believe the matter would have been dropped.

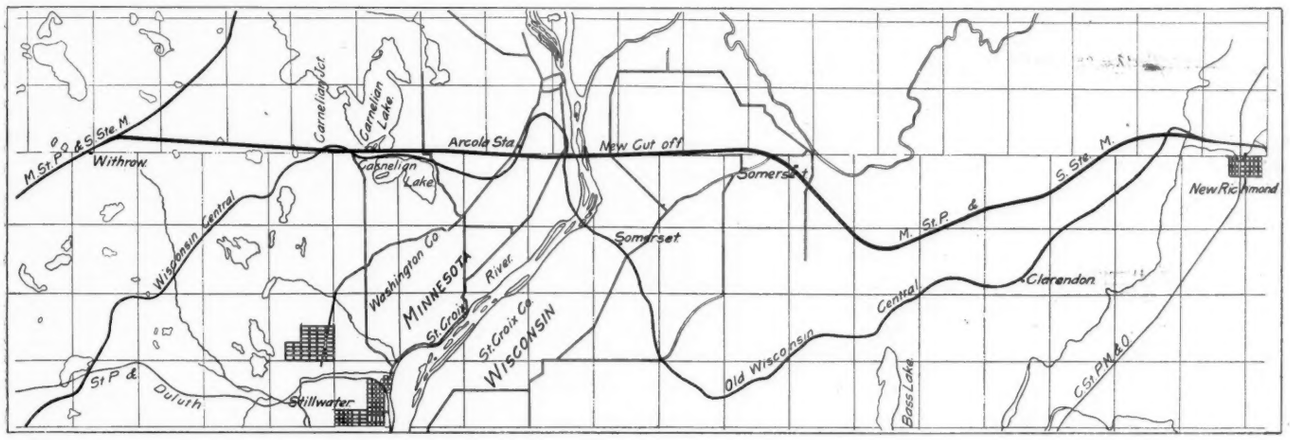
Another case. I was riding on No. 5. The flagman called out twice "The next station is Pecan," but in doing so he enunciated the word Pecan in so low a voice that it was not understood by all. Two ladies were sitting just opposite me and one asked the other what the name of the station was, adding that "you can never understand what they say." The other woman answered, "I did not understand him," and looking out of the window she said, "I am unable to tell you." I then gave the desired information; and as I saw the flagman coming through the train I requested the first woman to ask him what station he had just called, but she replied to me, "I will do no such thing; I do not

want his impudence." As the flagman got opposite me I said to him, "Flagman, this lady did not understand the name of the station just passed." The lady spoke up quickly and with a blush said, "Yes, I did; you said Pecan quite plainly." She was actually so intimidated, apparently by her general impression of trainmen's lack of courtesy, that she thus prevaricated in order to avoid discussion.

SOO LINE CUT-OFF FROM NEW RICHMOND TO WITHROW.

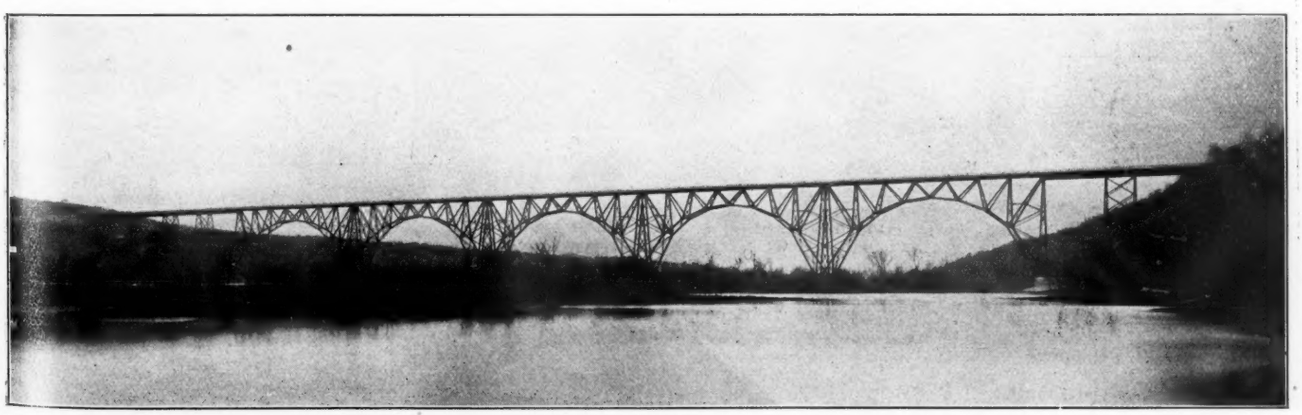
The main freight line of the Minneapolis, St. Paul & Sault Ste. Marie from Sault Ste. Marie, Mich., to Portal, N. D., does not enter St. Paul, but passes through the northern part of Minneapolis, although the company has its own tracks to its local passenger and freight terminals centrally located in both cities. A large amount of the company's freight traffic is for the far Northwest and does not need to be routed through the Twin Cities' terminals. The main line of the Wisconsin Central, which is now the Chicago division of the Soo, terminates at Trout Brook Junction, near the northern edge of St. Paul, where it connects with the Northern Pacific. A branch line of the Soo extends south from Cardigan Junction, on the main line, to the St. Paul terminals via Trout Brook Junction. As the company's principal freight terminal for the Twin Cities is at Shoreham, near the northern edge of Minneapolis on the main line, Chicago division freight bound for this yard had to be hauled southwest to Trout Brook Junction, then north on the branch to Cardigan Junction and then west to Shoreham. In addition to the indirectness of this route, the line of the Wisconsin Central for some distance out of St. Paul was very crooked, had heavy grades, and the class of equipment sent over it was seriously limited by the loading permissible on the steel bridge over the St. Croix river. In line with the policy of development on the Chicago division which had been adhered to since the acquisition of the Wisconsin Central, the Soo has built and recently placed in operation a cut-off running westerly from a point just west of New Richmond, Wis., about 40 miles out of St. Paul on the old Wisconsin Central line, to a connection with the main line of the Soo just north of Withrow, Minn. Besides affording a direct low-grade freight line to the Shoreham yard, the new line provides an alternate entrance to the Twin Cities for Chicago division passenger trains.

The locations of the old line and the new cut-off are shown on the accompanying map. The cut-off is 17½ miles long; it has a maximum grade of 0.5 per cent., and a maximum curvature of 1 deg. 30 min. The old line had grades as heavy as 1.3 per cent., and curves as sharp as 5 deg. The new alinement crosses the old five times between New Richmond and Carnelian Junction, the distance between these points being 14¼ miles by the new line and 18 miles by the old. The new line also eliminates about 1,300 deg. of curvature in that distance.



Location of New Soo Line Cut-Off.

The St. Croix river is crossed on a new steel arch bridge at a much higher elevation than on the old line, allowing the road to keep to the high ground with a much improved line and gradient. On the 17½ miles, about 1,300,000 yds. of material was excavated. A small portion of this work was rock, but most of it was a good grade of gravelly clay, which was easily handled and stood up well in fills. About 13,000,000 yds of overhaul was involved in the work. Foley, Welch & Stuart, St. Paul, were the general contractors, and the grading was sublet in small contracts. No difficulty was experienced in any of the earth work, and the fact that the entire contract was finished during the season of 1910 shows that the planning and execution of the work were of the best. All track laying and

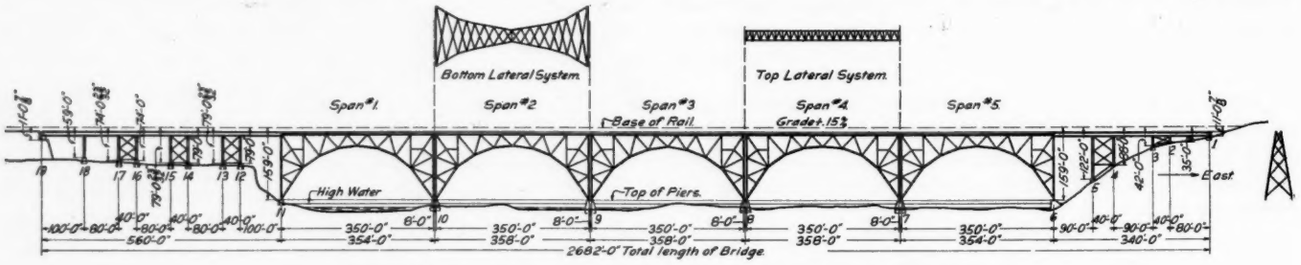


Soo Line Bridge Over St. Croix River.

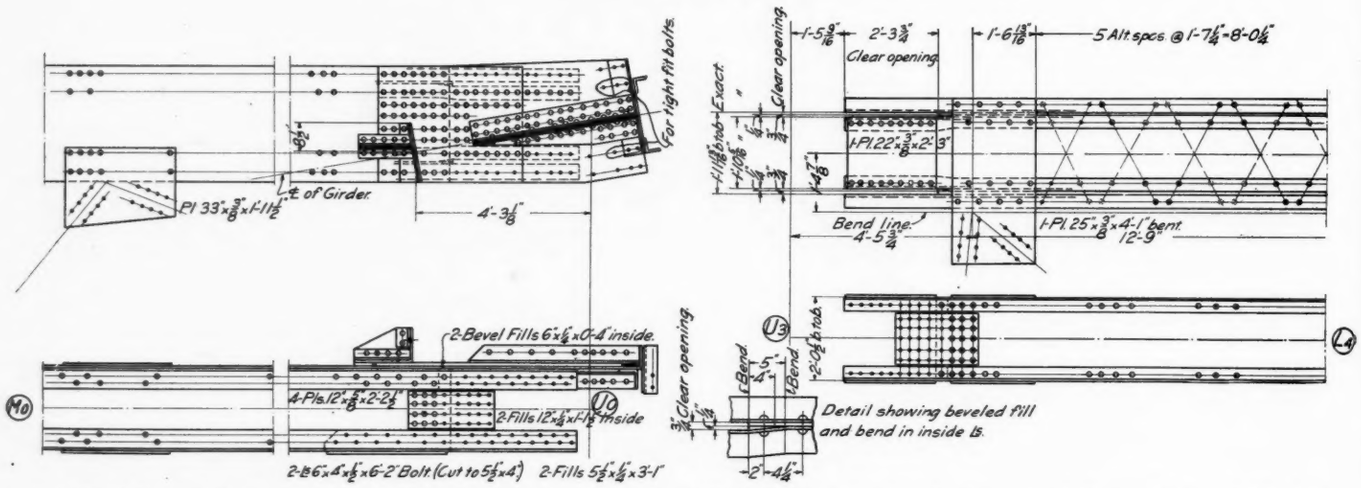
surfacing was handled by company forces. Gravel ballast, hard ties on curves and 85-lb. rail were standard.

The St. Croix river bridge has a total length of 2,682 ft., consisting of an east trestle approach 340 ft. long, five 350-ft. steel arches and a west trestle approach 560 ft. long. The elevation of base of rail on the bridge is 159 ft. above the tops of the piers, about 169 ft. above high water, and 181 ft. above ordinary stage of water. The design is made for Cooper's E55 loading and all steel work conforms to Soo Line specifications.

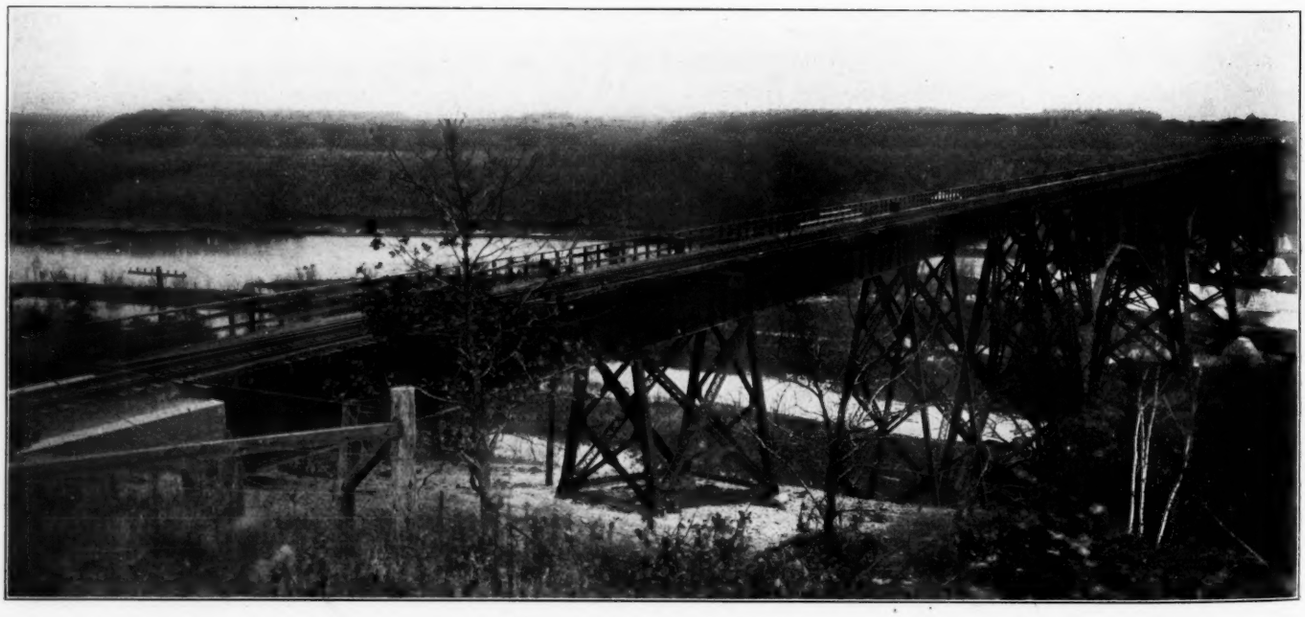
A trestle structure, using 100-ft. girders between bents and 40-ft. girders over towers, was considered for this location, and alternate estimates were made to compare arch and trestle types. The arch bridge was adopted because the comparison showed it to be cheaper and also a more rigid construction. It was found to require more steel than a trestle, and the shop work for the arch was more complicated, but these additional costs were more than offset by the saving in cost of foundations, since the pedestals for the towers would have had to be carried down to an extreme depth in order to rest on rock, and the cost of riprap for the larger number of piers would have greatly increased the total cost. An estimated saving of $35,000 to $40,000 was effected by using the design adopted. In addtion to its economy



Elevation of St. Croix River Bridge; Soo Line Extension.



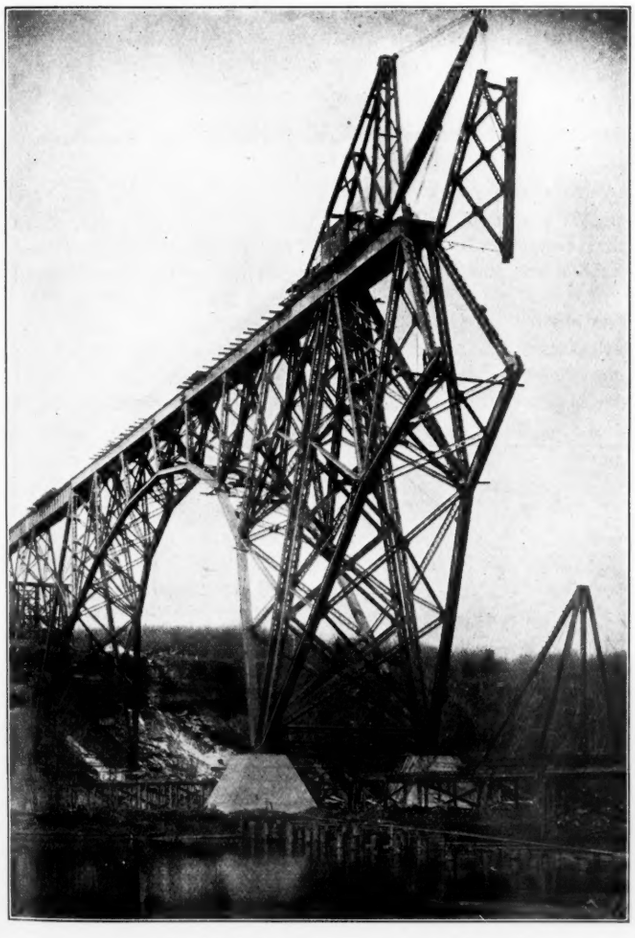
Details of Connections of End Post to Box Girder Top Chord and Deck Girder Approach Span; and Connections of Typical Truss Member to Top Chord.



Finished Bridge, From East End.

the bridge as built is probably the most rigid structure for its dimensions in the country. This rigidity is secured by inclining truss members 2 in. in 12, and by adopting a special design which makes the three-hinged arch act as a two-hinged structure under live load. The structure, therefore, has the advantages both of the provision for temperature stresses and the adaptability to inequalities or settlement of the piers possessed by three-hinged arches and of the rigidity under heavy loads which is characteristic of two-hinged arches. The design includes other noteworthy features, of which the most striking are: the use of horizontal skew backs; the makeup of compression members to allow a minimum of 30 per cent. of the gross section in the flanges; and the connection of inclined truss members to the box girder top chord by bent plates, eliminating floor beams.

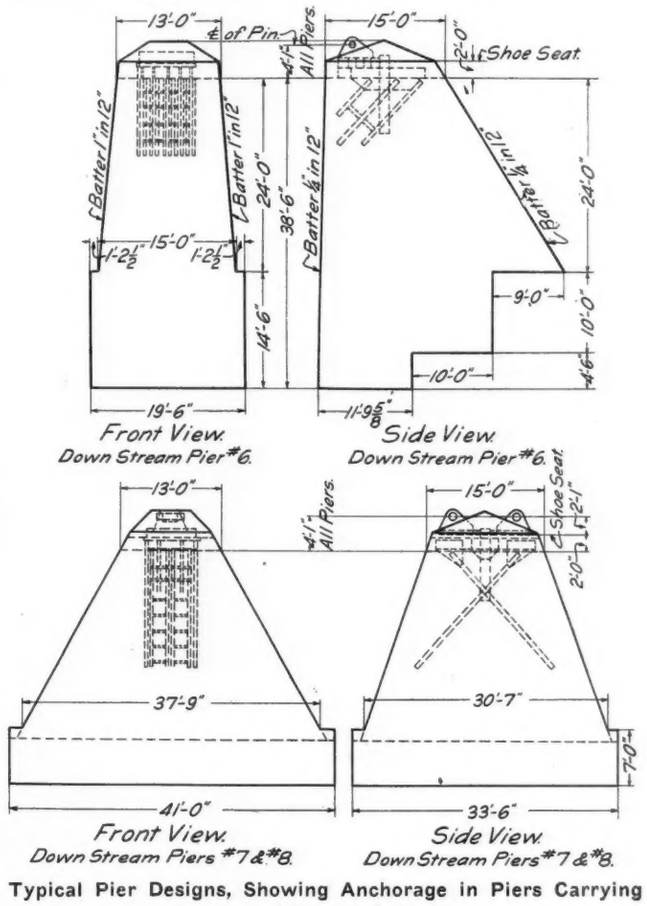
The use of a horizontal skew back was made possible by the adoption of heavy inclined anchorages in the concrete piers, as shown in the accompanying drawings. In piers 7, 8, 9 and 10, on which equal reactions from adjacent arches are carried, the anchorage is symmetrical about a transverse center line, the 18-ft. angles being inclined 45 deg. and crossed 5 ft. 7¾ in. below the center line of the horizontal channels. The cast steel bolsters supporting the shoes were shop-riveted to these channels and bolted at their inner ends to a vertical member projecting above



Erecting First Half of Second Arch as Cantilever.

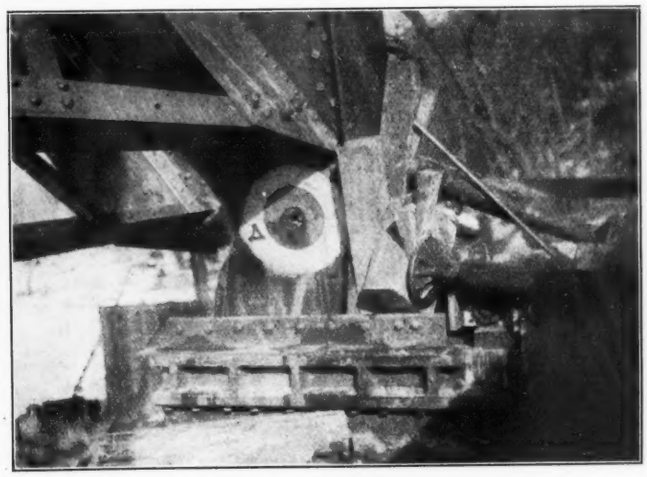
the channels and carried down to the intersection of the anchorage angles. In piers 6 and 11, which carry a single arch reaction, the anchorage is similar to that described, except that the angles are arranged in three parallel tiers, inclined 45 deg. from the horizontal in the direction opposite that of the arch reaction. The designs of typical piers are shown in the drawing herewith, No. 6 being an end and No. 9 an intermediate pier. The two end piers and all pedestals under the approach girders are founded on rock, but the intermediate piers under the arch spans are carried on piles spaced 3 ft. center to center and driven from 50 to 80 ft. deep, the depth to rock under these piers being 100 to 125 ft.

The masonry in the piers was placed from a light trestle driven parallel to the center line and adjacent to the upstream piers. A mixing plant was located at each end of the bridge and con-



Typical Pier Designs, Showing Anchorage in Piers Carrying One and Two Reactions.

crete materials were hauled to these plants by teams from the nearest stations on the old line. On account of the precipitous bluff on the west bank it was necessary to provide a cableway to lower the concrete from the mixing plant down to the trestle. The buckets of concrete lowered along this cableway were carried out on the trestle on small push cars and dumped from transverse trestles built over the pier locations. The trestle and



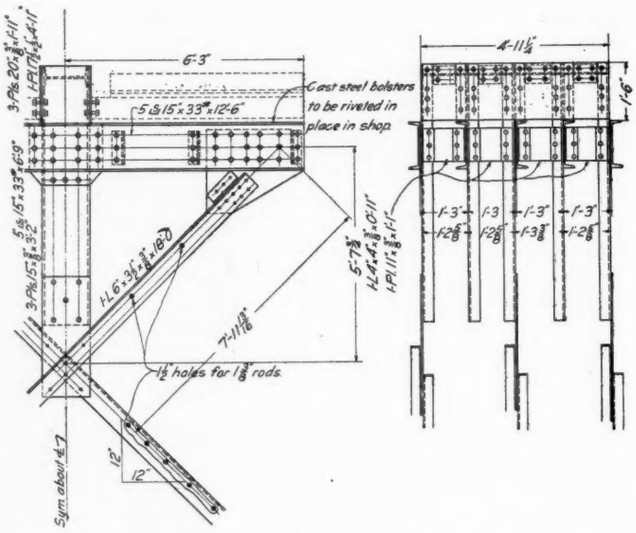
Adjusting the Footing of an Erected Arch.

the lower tower for the cableway at the west end are shown in one of the accompanying photographs.

The design of the lower chord is typical of all the heavy compression members in the structures. It is made up of four 6 in. x 3½ in. x ⅜ in. angles; one 34 in. x ½ in. cover plate; two 30 in. x ⅞ in. web plates, and four 6 in. x 6 in. x ⅞ in. angles. The gross area of this section is 114.18 sq. in., of which 61.68 sq. in., or 54 per cent., is in the flange. Although this ratio is not quite as high in some of the other members, it is never less than 30 per cent., which is considerably higher than the maximum ratio which is frequently used for similar designs.

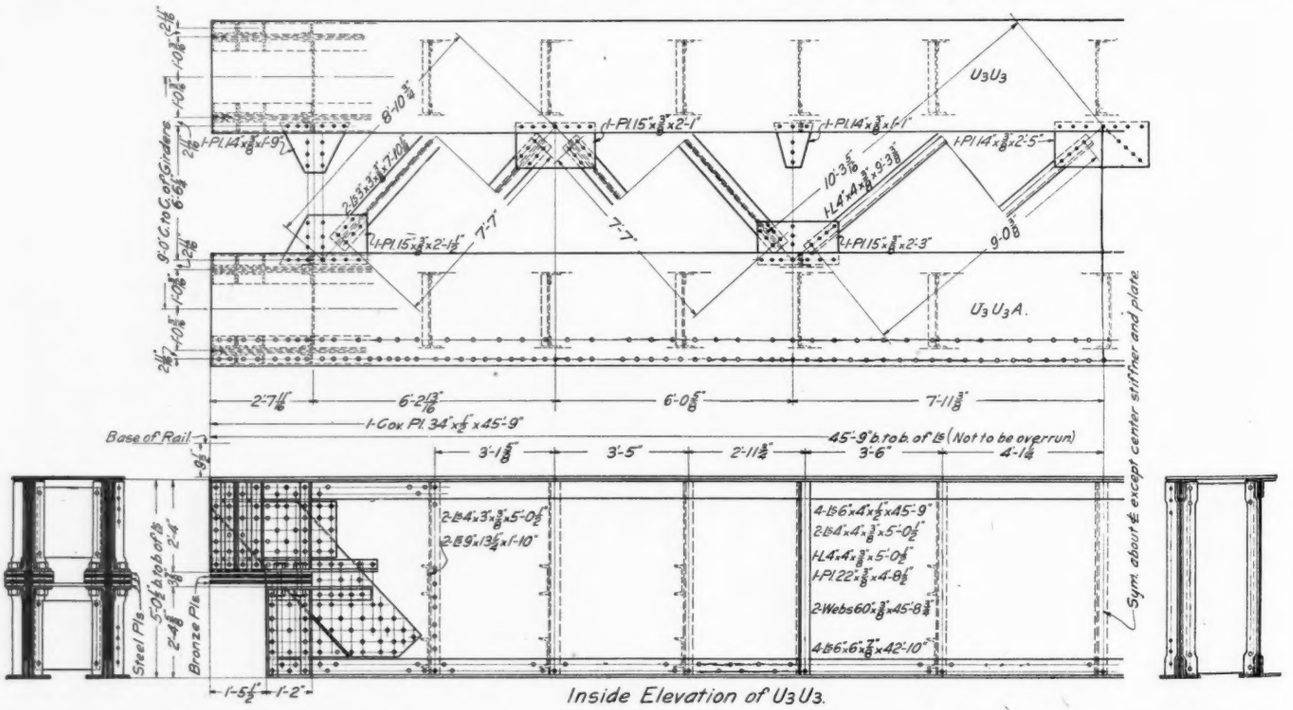
The top chord is a box girder 5 ft. 1 in. high, back to back of angles, and 2 ft. ⅜ in. center to center of web plates. These girders are spaced 9 ft. center to center and connected by lateral bracing. The upper chord is carried directly by the truss members through bent plate connections; the flange angles of the members being crimped to leave a clear opening between each pair of angles, into which the gusset plates are inserted, being riveted through the angle leg. The section of the top chord over the upper hinge is not connected to the truss members at either end, and it is supported entirely on projecting sections of the adjacent girders. The girders are cut to overlap 1 ft. 5½ in., and two bronze and three steel plates are inserted to form a sliding bearing. The center girder is heavily reinforced at the ends, as shown in the accompanying drawing, to care for the stresses caused by this application of the load. Under dead load this short section slides back and forth on its bearings as the bridge contracts and expands with temperature changes, the structure acting as a three-hinged arch. Under live load, however, these joints are locked by friction, fixing the length of the span over the upper hinge and forcing the structure to act as a two-hinged arch.

Trestle and Cable Way for Placing Concrete in Piers.



Details of Anchorage in Piers Carrying Two Reactions.

The erection of the bridge was accomplished very easily, considering its size. After the approach spans were completed the two end arches were erected on false work, which was very light and was practically all used more than once. The outer halves of



Details of Short Girder Over Center Hinge and Sliding Joint Which Effects Change in Action of Arch from Three-Hinged to Two-Hinged Structure; Soo Line Extension.

spans 2 and 4 were erected as cantilevers from the end spans, and false work was then placed from the ends of these cantilevers on which the remainder of the two arches was erected. Span No. 3 was erected entirely as a cantilever, the erection being carried on simultaneously from both ends. One of the photographs reproduced herewith illustrates the erection of the outer part of the second arch as a cantilever. The false work for the second half of the second arch was placed by a derrick car on the portion already erected. Four derrick cars were used; two on each end, one handling the members on the span and one unloading steel and handling material on the bank. In erecting the arches 9-in. wedges were provided behind the shoes to adjust the span and raise or lower the crown of the arch to bring it to grade. This eliminated the trouble incident to making the closing connection in the arch which would have been experienced if inclined skew backs had been used requiring the shoe to be permanently fixed before the erection of the arch. One of the photographs reproduced herewith shows the wedges for one span.

The foundation work on the bridge was begun in the fall of 1910, and the bridge was erected during the following winter and spring. The first train was sent over it in June, 1911. The entire work of building the new cut-off was under the direction of Thomas Green, chief engineer, and C. N. Kalk, principal assistant engineer. The design of the bridge was made by C. A. P. Turner, consulting engineer, and a number of the special features of the design are patented by him.

FOREIGN RAILWAY NOTES.

It is expected that the line connecting Taichon, Korea, and Kuasan, will be open to traffic by April, 1912.

In 1900 the operating ratio on the Prussian state railways was 61 per cent., and this rose to 74.62 per cent. in 1908. In 1909 it was 68.99 per cent., but was probably not less than 68.50 in 1910. It is estimated that in 1911 this ratio will be 68.63 per cent. The total annual receipts exceeded $500,000,000, therefore to reduce the operating ratio by only 1 per cent., means that $5,000,000 must be saved,

On December 31, 1909, the Belgian state railways had 4,093 locomotives in service, an average of over 150 locomotives for every 100 miles of line. This high average is justified by the great density of the population. The density of traffic is of course very great. Four-cylinder locomotives are favored for passenger train service, and although in France, Austria and Prussia this type of locomotive is seldom used without the compound engine, in Belgium the simple engine is still in favor. It is claimed that by the use of Schmidt superheaters, an economy can be obtained equivalent to that of the compound system. In freight locomotives the simple engine is used exclusively in Belgium. On the other hand of the 600 freight locomotives ordered by Prussia in 1908, 334 were compound, and of the 328 locomotives ordered in 1910, 135 locomotives were compound. The Belgian locomotives have six-coupled wheels. In 1909 the passenger equipment included 9,954 cars, or 370 for every 100 miles of line. Since 1904, corridor cars were ordered with three trucks equipped with Westinghouse brakes and steam heating apparatus. At the end of 1909, 1,571 cars were lighted with incandescent lamps with metal filaments. At the end of 1909 the freight equipment included 82,302 cars, an average of 460 cars for every 100 miles, furnishing a total capacity of 1,020,626 tons for all cars. Recent orders have been almost entirely for cars of large capacity (for Belgium), such as 15-ton box cars and 20-ton coal cars. In 1904 there were only 650 coal cars of heavy capacity, but this was increased to 6,037 at the end of 1909. The number of 10-ton box cars in 1904 was 9,998, and of 15-ton box cars, 3,958. In 1909 the number of 10-ton box cars was 10,503, and of 15-ton box cars, 7,197.

"QUESTIONS OF THE HOUR."*

BY F. A. DELANO,
President, Wabash Railroad.

While we have inherited from our Saxon forefathers a belief in the Town Meeting as a good place to discuss questions of the hour, yet when it comes to holding such discussions, business men today shy away from them. Indeed, it is an unfortunate but somewhat notorious fact that the questions which concern our business life are rarely discussed in the open by business men, and the man who does it is apt to be looked upon with suspicion by his fellows, as a theorist.

The effect of this failure on the part of the business men of the country to look after these important questions of law-makers and law-making, is that a few hundred men sitting in our federal and state legislatures have really played "football" with the business of the country. George W. Simmons of St. Louis recently stated the case well when he said:

"It seems to me quite natural, however, that this should be so when we reflect that in this, the greatest commercial nation of the world, upon whose prosperity depends the prosperity of the world, where we have over fifteen millions of people engaged in trade and manufacture—we have less than fifty members of Congress who are business men. There are said to be 135,000 lawyers in the United States, and yet they are represented by 212 lawyers in our National Congress. These lawyers, learned as they may be in the law or in the theoretical side of business, cannot, because of a lack of actual experience, know the commercial needs of the country as those men know them whose very bread and butter, the happiness and welfare of whose families and those nearest and dearest to them, are entirely dependent on their insight into, and their thorough mastery of, the commercial problems of the day."

The spectacle of 10 to 12 million men and women working by the sweat of their brow to produce wealth that supports us all, led around by the nose by this relatively small number of drones in the human hive, is, indeed, pathetic.

And yet it would not be fair to put all the blame on the politicians who represent, or even those who misrepresent us. We nominate and elect them and rarely tell them what we think they should do. Theoretically, they are servants of the people; practically, they are watching the headlines in the papers and trying to catch the popular key.

It is, therefore, with more than ordinary temerity that I venture before this audience to take up some of the problems which concern every one of us; but I do so, not so much to express new or advanced ideas, but to say out loud what I think many business men believe. I have taken for my subject, "Questions of the Hour," and propose to deal particularly with these three closely related questions:

The railway question, the tariff question and the trust question.

THE RAILWAY QUESTION.

As you all know, the Interstate Commerce law was passed in 1887, nominally in the interests of the general public, but more particularly of the shippers. The truth is, not one man in a thousand knows anything about freight rates, and public interest in the question has been a manufactured and inspired interest. Few people realize that on the commodities which are concerned in our daily lives, such as food and clothing, the rates of freight bear an insignificantly small percentage of the cost of the article; thus, on a piece of beef which retails at from 20 to 35 cents per lb. in Chicago, the rate from Kansas City or Omaha to Chicago would be less than 2 mills. On a ready made suit of clothes, which retails at from $20 to $40 in Chicago, the rate would amount to from 3 to 4 cents. On shoes retailing at from $2 to $6, the rate from Boston to Chicago would be about 2 cents.

A fifty-pound sack of flour retailing in New York at $1.50 pays a freight charge of 12½ cents from Minneapolis to New York. A suit of underwear retailing at from $1 to $5 pays a freight charge from New England mill points to Chicago of less than one-half cent per suit.

But it is easy and often convenient to blame the railways, as

*An address before the Toledo Transportation Club, November 24, 1911.

when I heard a retailer say to a customer who was complaining that he had to pay a higher price for an article which he had frequently bought: "Well, you know the railway rates have gone up." The customer knew nothing about the facts, and the explanation was accepted.

Not many months ago, an effort on the part of the railway companies to get an advance in rates met with a refusal from the Interstate Commerce Commission. Shortly after that time, I startled some of my good friends, especially in the railway fraternity, by stating that possibly that decision was a blessing in disguise, for the reason that the railways needed public sympathy, and favorable public opinion, even more than higher rates. This statement, by itself, was freely used in the headlines, without qualifying remarks, and was misunderstood. However, I believed then—and believe now—that while railways needed higher rates, there were other things they needed more. Furthermore, the Interstate Commerce Commission had good reason to hesitate in adopting the policy which proposed that, because the employees of the railways thought their wages should be increased, freight rates should, therefore, be advanced, and thus throw the burden on the ultimate consumer. True, this method had been successfully introduced by other employers, and in a most notable instance in this very state of Ohio, when the late Senator Hanna perfected a scheme for avoiding a strike of coal miners, by granting them the increase on conditions that they would help the operators to secure an advance in the price of coal from the consumer. However, that did not make it right or advisable.

As an economic policy, it is faulty; and the railway companies, being large consumers of many articles, have suffered along with the general public by its common acceptance. It is a policy of taking the easiest way and letting someone else take the consequences. Sooner or later this policy was certain to come to an end, perhaps, the refusal of the commission to permit railways to advance rates may be the thing we need to bring us all to our senses.

And yet, railways needed something, and everyone who knows realizes that they are having very hard times. Furthermore, until their purchasing ability is restored, we cannot have good times. In other words, there is no question that the margin between earnings and expenses, which has been steadily decreasing, is too small and that the railways need today, as when they made their plea, either an increase in rates, or some assistance in decreasing expenses.

My position, therefore, is that while I see good reason for the commission's decision, I have objected to their reasoning. I should have been better pleased if the commission in declining the request of the railways had done so on the ground that it was a faulty, economic theory; that the proposal to increase rates in order to increase wages was introducing a *deadly cycle* that would never terminate. If the commission, in declining the request of the railways, had permitted some of the rates to be advanced where they appeared to be too low, and had pointed out wherein railways might economize, they would have done valuable constructive work. Instead of this, the request was declined by citing the condition of the most notable carriers in the country and by arguing that because those carriers might survive without help, the railways, as a whole, did not need it; whereas, the argument of railway men has always been that it wasn't fair to limit the exceptionally successful railway to a moderate profit unless the country was ready to grant some sort of a minimum to the less successful; for, if railways, like other undertakings, are to stand or fall simply by the ability and shrewdness of their management, the necessities of the average—and not of the most favored—must be considered.

However, the case was decided; and, being law-abiding citizens, the railway companies have accepted the decision and are doing the best they can to economize, learning some hard but useful lessons in the effort. True, we haven't yet discovered how to save a million dollars a day, as was suggested could be done, and yet there is not a railway man who does not realize the great possibilities of economy. To some of us it occurs that the same commission which denied the request for an advance in rates might very properly assist the carriers in securing the economies, for the reason that many of these economies are beyond the ability of the railways to accomplish unaided; as I shall venture to explain.

The most promising source of economy is in reduced train service; that means better loading of trains, both passenger and freight. This is the direction of economy which transportation service the world over has taken. Thus, the great Olympic, of 45,000 tons, with its capacity of 2,500 passengers and a crew of 1,000 men, takes the place of vesssels of less than half the capacity and scarcely ten years old. Familiar examples even nearer at hand might be cited in the case of your 600-ft. ore carriers, with 12,000 to 14,000 tons capacity, discharging their cargo from thirty-two hatches in four hours' time. Not many years ago a vessel of half this tonnage was considered very large on the Great Lakes. The three-horse dray, the five-ton motor truck, are other examples.

Some of the most notable instances of economic waste in train service are found between our large cities. Thus, between Chicago and St. Louis, four trunk lines operate four trains each way on practically identical schedules. It is safe to say that ten or twelve trains, at the most, would accommodate the passengers as well; and if by reason of mutual understanding and approval by the Interstate Commerce Commission, these trains were run at different hours in the day, instead of being run on identical schedules by each road, the public would be really benefited.

Very similar conditions exist between Chicago and St. Paul, where seven roads operate from two to three trains a day on identical schedules; and other cases might be given in illustration almost indefinitely. To illustrate how it affects the public, I might cite the case of a friend who wished recently to go from Chicago to Seattle. Three routes were open to him. Each could furnish a good train leaving in the forenoon and one late at night. This man, who knew nothing of railway service, said to me: "Why doesn't one of these roads run its train earlier in the evening, so as to get me to Seattle a little earlier and give me a little more time there?" I then had to explain that each of the three roads must, in order to compete with its rival, match the service of the others, assuming a schedule which would be most popular. The result, of course, was that while six trains were operated between Chicago and Seattle, a traveler wishing to make the journey had practically only a choice of two hours of departure at his disposal.

Some of my hearers might say: "Why do not the railways get together and adjust these matters?" The answer is that "getting together" is made as difficult as possible, and an agreement is not only binding on the parties, but is—we are told—in contravention of the Sherman Anti-trust law.

In freight schedules, in the same way, some absurd conditions exist. Between New York and Chicago five routes maintain a 60-hour schedule, although it is generally conceded by shippers that a schedule twelve or even twenty-four hours slower would answer all requirements of most important freight, if made with regularity. For any one road to go single-handed to a slower schedule would mean business suicide. For the five roads to agree together would mean a "midnight" injunction. And yet it is safe to say that just in such ways as these millions of dollars might be saved, and the community better served.

As a concrete suggestion for the consideration of the Interstate Commerce Commission and our lawmakers as well, why wouldn't it be proper for the commission to require time schedules to be filed in the same way that tariffs are filed, subject—like them—to thirty days' notice, and subject to suspension by the commission? If the oft-repeated statement is true—that the service rendered is just as much a *consideration* as the tariff charge, why wouldn't this be a proper function of supervision by the commission?

And there are other ways in which money could be saved on

the railways, which, in the aggregate, would go a long way towards the million dollars a day which our Boston friend, Mr. Brandeis, suggested; ways in which our lawmakers, instead of making it more difficult, might make it a little easier. Why, for example, should our lawmakers in one breath pass a statute requiring the railways to equip all their freight, as well as passenger cars with air brakes, so that—as the act recites—every train shall be controlled from the engine by the engineer's hand on the brake valve—and in the next breath pass a law—as has been done in many states and is threatened in the Federal Congress—requiring the railways to put a third brakeman on every train? There is a thinly veiled suggestion that this third brakeman is for the protection of the train; and yet not a railway man in this country but knows that, far from being there for safety or any useful service, he is simply one more man to be jeopardized in case of accident; for, with few exceptions, railway hand-brakes are never used in road service.

And why—I may be asked—should the public be interested in seeing the railway companies make a fair margin of profit, either by increasing some or all rates, or by diminishing wastes in operation? The simple answer is that the railway is the greatest purchaser in the country. Indeed, for every dollar taken over the counter, 42 cents—on the average—is spent directly in wages, and another 26 cents is spent for material, raw or manufactured. And this comes out before the creditors receive interest on their loans or the owners any dividends on their property. It is axiomatic that there cannot be any degree of prosperity in this country with the greatest single industry in a bad way; but it is a truth which cannot be too often stated.

Another way to reduce expenses is to reduce the cost of materials to the railways, and in this we find the tariff is involved, so we come to the tariff question.

THE TARIFF QUESTION.

When the railways were asking for higher rates my slogan was: "Give us higher rates or a reduced tariff." Certainly the tariff question is one in which the railways are vitally interested—quite as much as the general public. The railways are paid for transportation in coin whose purchasing power to buy coal, ties, lumber, rails, iron and steel, locomotives and cars has been steadily diminishing. In only one commodity, namely, cement, has there been any gain to the railways in the last fifteen years; and yet railway men realize that this tariff question must be dealt with cautiously, sanely—not savagely or brutally.

Even granting, as I believe to be the fact, that our high tariff was a good economic scheme as a temporary method of fostering manufacture in a new country, and that when it was continued beyond that point it became a tax on the many for the benefit of the few, still the manufacturing business cannot readjust itself to sudden changes. To my mind, the most serious difficulty today with the business of the country as a whole is, not that conditions are bad, but that there is a lack of certainty as to what is to happen next. Manufacturing and commerce can adjust itself to reasonable changes, and if any policy, gradual or progressive in its nature, were adopted by this country along a definite program, there would be no difficulty in an adjustment from a high tariff to a low tariff or tariff-for-revenue basis. But it is the uncertainties of tariff and the uncertainty of law that makes for business unrest and dissatisfaction. It is to be hoped that with the help of the bi-partisan tariff board now sitting on this question, we may arrive at an adjustment of these difficulties sanely and progressively, to sound conclusions. And if business men will work together, this can be brought about.

And now we come to the consideration of the trust question

THE TRUST QUESTION.

The Sherman Anti-Trust Law is also a law which concerns the railways as vitally as it does the general public. We first experienced the rigors of this law, for although after its passage, twenty-one years ago, it lay inactive and dormant, like so many of our laws, it was first actively invoked against the railways. I confess to a prejudice against the law; I have never regarded it as a *sincere* piece of legislation. It has always seemed to me a piece of political *buncombe*, which was passed in order to furnish campaign material. Be that as it may, it is notable that the first important case under it was that brought at the instance of the shippers against the railways in the Trans-Missouri Freight Association case, decided by the Supreme Court in 1897, in a very close decision. In this decision, and that against the Joint Traffic Association two years later, an action was brought against the railways for having formed an association, the real purpose and effect of which was to hold rates from being cut by reason of an agreement between the roads to observe the Interstate Commerce Law and not to pay rebates or to adopt any of the methods or devices which the law then, as well as now, said were illegal.

It is small wonder, therefore, that railway men, who were thoroughly discouraged by the result of the Anti-Trust decisions in '97 and '99, laugh in their sleeves when they see the manufacturers and merchants who were their accusers then, haled into court now under the very same law. It is only human of us to say: "I told you so. Our turn came first; your turn was bound to come next." But, now that we have all had our turn at it, instead of calling each other names, might we not better get together and consider the law itself? I am well aware that a large part of the community believe that the law should be enforced; and, unquestionably, while it stands on the statute books, it should be, even if it is—as I have suggested—an insincere piece of legislation, never meant by many of those who helped to put it on the statute books, to be literally and absolutely enforced. Viewing the law even from the most generous and reasonable viewpoint of our Supreme Court, is it a sane piece of legislation, and is it in line with the development of industry everywhere; e. g., England, Germany, Belgium, etc.?

It is maintained by many that competition must not be stifled, and yet there is probably not a man in the United States who does not know the terrible extremes to which free and unlimited competition may finally lead. Is it better that the lion and the lamb should lie down together with some sort of a "live and let live" understanding, or is it better that the lamb should lie within the belly of the lion? I do not set myself up as knowing what this law means, but I do say that if it really means, sincerely and honestly, to say what its words appear to an ordinary layman to say, I am inclined to think that 90 per cent. of the business of this country is in contravention to it. Then, I ask myself, must the business of the country all be disrupted and a readjustment made? To paraphrase the Good Book, I might ask: "Is man made for the law, or is the law made for man?" Must grocers "A" and "B," on the same street, cut each other's prices on butter, eggs, and other commodities, in spite of the fact that they have come by common experience to see that they can't afford to do it; and if this sort of ruinous competition is kept up, the ultimate end must be the survival of the fittest. Can Smith and Jones be compelled to compete, in spite of their conclusion, that it is better to live and let live? May not Brown and Williams belong to a labor union under which they pledge themselves that they will not work for less than a stipulated wage? Is the Sherman Anti-Trust Law to be enforced against the A. & B. labor federation? And what has become of the promises and protestations of our republican friends who some two or three years ago were satisfied that the Sherman Anti-Trust Law should be amended in some important particulars, but who are now saying that it is just exactly right, and should be enforced; that the decisions of the Supreme Court make the law as clear as day (*sic*), and that anyone ought to be able to see how he can live within it?

These and many other questions appeal to every man of business, and, indeed, to any thinking citizen. To me it has appeared perfectly apparent that the competitive system can only operate successfully if the state is ready to protect, in some measure at least, the weaker against the stronger. And in saying this, I assure you I believe earnestly and heartily in competition as the

best spur to any man's intelligence, ingenuity and self-development, but I can't see the sense of a law which says that A. B. & C. must compete and yet does not protect B. & C. from annihilation by reason of the greed or greater business capacity of A. I can't see the sense of law which says that A. B. & C. may not combine, and yet, by reason of the complete annihilation of B. & C., allows A. to survive alone in their stead.

While I contend that unlimited competition cannot be permitted without some provision for protection of the weaker, I believe, by the same token, that when as a result of competitive methods or otherwise the law of competition no longer applies, the state should have some right of supervision. That might properly be one of the penalties of greatness. So long as a dozen concerns in the iron business compete freely, and the price of iron products is regulated by the natural laws of competition, the public is amply protected; but just as soon as competition is obliterated, and, by reason of combination of the dozen concerns, or by reason of the annihilation of eleven of them by one survivor, the law of competition is nullified, then might not the state properly step in? I am aware that when I suggest this my friends will say: "Ah, but this is a dangerous authority to give to any man or set of men! It is a dangerous menace to free institutions." And my answer is that while it is a great extension in the powers of government and one I really do not like to urge, yet it is exactly the authority which the Interstate Commerce Commission has over the railways today. The commission does not make rates, but it has a right to say that they are too high or to fix a maximum, and the right to say that they are discriminatory, which obviously gives them the right to say that they are too low, for too low rates may involve quite as serious discrimination as too high rates.

After all, the greatest safeguard which the public has to rely upon in public supervision, far more potent than state or federal commissions, and at the same time inexpensive, is *publicity*. Many a small manufacturer or merchant makes 25, 50, or even 100 per cent. profit. I have known in my experience many such cases. The public knows nothing of these profits and is apparently indifferent to them, but let these manufacturers go into a joint combination, or trust, and let them show by published reports that they make 8 or 10 per cent., and they will at once become the target of hostile attack.

Many may say that it is a short step from the supervision of prices by the government to the control of all business by the government, or what might be termed "state socialism." To my mind, however, there is a very wide gulf between private ownership and operation with public supervision and public operation. And yet private ownership is successful only so long as the incentive of a fair margin of profit exists. This incentive is a valuable aid to efficient methods, and, when the possible excesses of human greed are held in check by publicity and supervision, represents to my mind almost ideal conditions. No private corporation could survive and be run as our municipal, state or federal governments are run. I do not mean that our private corporations are necessarily more honestly conducted, for that is not the feature by which they are most clearly differentiated. Rather is it the fact that in corporate management there is a necessary and indispensable relation between income and outgo; the cost of manufacture and service must be accurately determined, conditions which do not exist in governmental operations.

So far as I know, most governmental functions cannot be accurately measured. There is no standard of efficiency and it is notorious that in the mazes of bureau figures the most astute accountants find it well-nigh impossible to dig out any conclusive figures. Again, I say this isn't because government officials are less honest, but because there is inherent to governmental methods no commercial check, the inexorable check of income and outgo—there is practically no responsibility for results. Of course, there are occasional exceptions, here a bureau, and there a department, where efficiency and economy prevail, but these are the exceptions and not the rule.

IN CONCLUSION.

After all we *need less law, not more law.* We need an intelligent revision of our entire code of law with the assistance of practical men who know whether the laws can be enforced, and lastly, we need greater respect for, and enforcement of, the law. We should insist that the government which sets itself up as a critic of all business methods shall adopt an efficient system of accounting, cost keeping, annual reports promptly issued in a form intelligible to every citizen, and give the business man a chance to know what he gets for his taxes. There is not a railway so poorly run that it does not issue to even its smallest stockholders a report of each year's operation. This is equally true of every important industrial corporation. Why should we not have the same sort of information about all government departments—federal, state, county and municipal.

My conclusion as to our trust law is that it is far behind the practice and necessities of modern business, as demonstrated by experience abroad, as well as here. The remedy is not in finding how to evade this law, however, bad it is, but a united effort to get an honest, sincere law which decent men can and will live up to. If business men believe this, why should we not come out in the open and discuss it?

I believe an important remedy of the conditions surrounding us is plainer speaking and more frankness. We, as business men, do not believe that business methods are bad as a whole—indeed, I think that business ethics are better on the whole than professional ethics. Before we talk of greatly extending governmental authority and multiplying bureaus (the expansion in the last twenty years has been almost beyond belief), let us insist on getting governmental methods a little nearer to the efficiency of ordinary business methods.

RAILWAY CAPITAL: BONDS VS. STOCKS.

BY WILLIAM Z. RIPLEY,
Professor of Economics, Harvard University.

The first railways in the United States were built from the proceeds of sales of stock. Only after demonstration that they were legitimate investments, rather than speculative enterprises, was resort to bond issues possible. And then, also, it took time to discover that raising part of the necessary capital by borrowing at a fixed rate of return, gave opportunity for concentrating all the surplus earnings upon a relatively small capital stock. The Baltimore & Ohio was largely financed by stock issues, a goodly proportion subscribed by the state of Maryland. The annual report of the road for 1844 showed $7,000,000 capital stock as against only $985,000 of bonds; and even five years later, its outstanding stock was twice as large as the bonded indebtedness. The southern states, led by Virginia, gave most of their aid in early days by direct stock subscriptions. Virginia alone took about $21,000,000 par value before the Civil War. In 1855 the total issues of stock in the United States exceeded the amount of bonds by 42 per cent. To this day, a large number of the original small New England roads comprised in the Boston & Maine or the New Haven systems have no bonded debt at all. Nearly three-quarters of the entire capital of the Boston & Albany in 1907 was still stock. These conditions are all vestiges of the earliest practice in railway financing in this part of the country. In a measure the practice persisted in western enterprises directed from Boston. The old Atchison road in its palmy days of expansion was largely financed by stock issues. A radical change ensued in the subsequent years. In New England and the middle states, and in the South after 1865, public aid was usually given in the form of bonds, the stock being held in private hands.

The issue of bonds in railway construction first attained prominence between 1855 and the close of the Civil War.

Speculation was rampant. The railway net was being rapidly extended, almost without regard to economy of construction. And, most important of all, state aid was being widely granted, either through subscriptions to bonds, official guarantee of interest, or exchange of state and municipal bonds for railway bonds. Prior to 1870, the state of Massachusetts alone had loaned $11,290,000 in these ways. New York had taken $8,200,000, likewise in bonds. Southern states like Tennessee, had substituted bonds for stock subscriptions, as a stimulus to new enterprises. During the Civil War period, however, in the East, the financial center of the country, the huge issues of United States bonds, seem to have absorbed much of the loanable capital of the country. The Pennsylvania, New York Central and Illinois Central for example, either ceased augmenting or actually decreased their bonded indebtedness. Bonds were still the main reliance. In the pioneer enterprises with stock issues rather as a bonus than a mainstay. As soon as the war was over, and particularly upon the establishment of closer financial relations with Europe, bond issues reassumed prominence even in the East. Little European capital came to this country in any other form than mortgage loans. The late sixties, with the exploits of Jay Gould and his associates in the Erie and other properties, greatly augmented the proportion of bond issues as compared with stock. The Erie had always led in this sort of financing. Even as early as 1851 it had $14,000,000 of bonds outstanding, with only $6,000,000 of stock. Commodore Vanderbilt, on the other hand, was much averse to the issue of bonds by the New York Central; and was finally persuaded to do so only on condition that he buy and hold them himself. As for the trans-continental lines, such as the Union and Northern Pacific, no other resource than bond issues was possible; and the same thing was true of most speculative construction in the West. Matters went on thus until the chapter was ingloriously closed by the panic of 1873, when nearly $500,000,000 of bonds defaulted in interest.

The period of twenty years from the reorganizations incident to the panic of 1873, continued to show heavy reliance of railway financiers upon borrowing as a means of finance. This was especially true of the Trunk Lines during the period of the rate wars after 1874. The Baltimore & Ohio, which until this time had been conservatively mortgaged, became hopelessly involved in debt within a few years. By the late eighties, the percentage of its income absorbed by fixed charges, ran up from about one-third to nearly nine-tenths. With the beginning of official data for the United States in 1889, it appears that for the country as a whole, stock and bond issues had reached a rough equivalence; although in part of the South, in New England and the Far West stock issues still appreciably exceeded the bonded indebtedness. Above this proportion of equality, it was not possible for bonded indebtedness to go under the corporation laws of many states. Several years after this time the general trend was still in the direction of increased bond issues so far as new financing was concerned. To borrow, in other words, was easier than to secure stock subscriptions from shareholders. Mortgage indebtedness continued to grow at the expense of stock, wherever it was possible. The proportion of reasonable safety was exceeded in many cases, until the rude shock of another financial panic again restored a proper balance.

The four years of industrial depression following 1893, were marked by the bankruptcy and reorganization of a great many railways. No less than one-sixth of the mileage and one-quarter of the aggregate capitalization of the railways of the United States fell into the hands of receivers, because of inability to meet fixed charges out of current earnings. The unwise and reckless amount of borrowing in the preceding years is well evidenced by this fact. It was inevitable, therefore, that the extensive readjustments of railway capital incident to the reorganizations of this time should have as a prime motive the reduction of fixed charges in proportion to income. This reduction was effected by the exchange in many cases of bonds, on which default of interest had occurred, for preferred stock with a dividend lien contingent upon earnings.

Fifty-seven companies, reorganized during this period, effected a reduction of fixed charges to the amount of $19,600,000. The seven principal ones cut the proportion of net income required to meet fixed charges by nearly one-third. Atchison in 1895 lessened its fixed charges by $4,185,000; Northern Pacific in 1896 by $4,755,000. Prior to 1895 the annual increase in railway capital had shown usually a large preponderance of bonds. During 1895 a change took place, stocks increasing during that year $127,000,000 and funded debt only $28,000,000. For the year 1896 stocks increased $265,000,000, while funded debt actually decreased $45,000,000. The next year, for the first time in many years, the amount of stock outstanding exceeded that of the entire funded debt.

With the return of normal conditions in 1897, the trend in favor of bond issues instead of stock as a means of railway financing once more became pronounced. At the present time mortgage indebtedness has again so far increased as to constitute, in the opinion of conservative students, a menace for the future. The extent of this resort to bonds, rather than stocks, is shown by the accompanying table.

PAR VALUES—TOTAL OUTSTANDING SECURITIES, ACTIVE CORPORATIONS—JUNE 30, 1906.

Funded Debt.	
Mortgage Bonds	$6,646,472,000
Collateral Trust Bonds	1,303,329,000
Income Bonds	167,698,000
Equipment Obligations	241,425,000
Plain Bonds, Debentures, Notes, etc	571,760,000
	$8,930,687,000
Stock.	
Preferred Stock	$1,588,169,000
Common Stock	6,524,931,000
	$8,113,101,000
Total Outstanding Securities	$17,043,788,000

The complete reversal of the tendency during the lean years 1893-7 is made manifest. The two forms of capital, representing ownership and indebtedness respectively, remained about even until 1902; but since that year bond issues have so far predominated, that in 1907 they exceeded capital stock per mile of line by nearly ten per cent. Otherwise stated, there were outstanding nearly $5,000 more of bonds per mile of line than of share capital. Thus it has come about, that despite the relatively low rate of return upon bonds, fixed charges in the form of interest in 1907 absorbed fifty-three per cent. of the total charges against railway income on account of capital.

Only two exceptions to this trend in favor of bonds have occurred of late. For the year 1900 the increase in stock was more than two and a half times as great as the increase in funded debt; but, as the statistician of the Interstate Commerce Commission remarks, this can hardly be interpreted as a healthful tendency, since the increase in indebtedness alone exceeded the probable cost of railway construction during the year. During 1906, and perhaps as a result of President Roosevelt's campaign in favor of regulation of stock issues by Federal authority, four trans-continental roads alone speedily announced an increase of approximately $350,000,000 in share capital. This was a difficult time, when bonds for improvements, like the St. Paul extension to the Pacific Coast, were unsaleable. Funds could be secured only by issues of short term notes or of new stock, carrying valuable "rights" to participating shareholders. The publicly-announced change of policy of the Union Pacific road since the death of Mr. Harriman, whereby new financing will be accomplished by stock issues rather than the sale of bonds, is significant. There is general recognition of the fact that mortgage indebtedness has been excessive during the decade to 1910.

Several distinct causes for this relative preponderance of bond issues in recent years are traceable. These causes are quite different from those of the extensive bond issues of a genera-

tion after the Civil War. In those years stocks were almost always below par. To issue new stock at par was an impossibility. To issue it for less than that figure entailed heavy financial loss. Bonds alone could be issued to sell at or near their face value. This condition has radically changed now-a-days. The general level of market prices of high grade railway stocks is now well above par. It would appear as if it would be easier to raise new capital by sales of shares. That it has not been done requires some explanation. In the first place, prolonged relative prosperity and steady growth of income always invite increased borrowing. Bonds are readily saleable in good times. Capital borrowed yields larger returns than prevalent interest rates, on the loans; and stockholders are liberally rewarded by focusing these increased earnings on a fixed capital stock. Also, it is far easier to insure continued control of a property with a relatively small capital stock, if closely held. If not thus held, of course, a small capital stock renders speculative raids the more easy. This is well exemplified by the pitiful history of the Cincinnati, Hamilton & Dayton. New bond issues do not invite speculative raids, such as that by which the control of Louisville & Nashville was secured in 1902. Moreover, sale of bonds only can be resorted to either for drawing upon European stores of capital, or the huge investment surpluses of the great insurance companies and savings banks. Stock sales are more apt to be restricted to private investors; while institutions and trustees, even in the most conservative states like Massachusetts, are often permitted to purchase railway bonds, if properly secured and if not issued in excess of the outstanding capital stock. Hand-to-mouth financing also usually leads in the direction of mortgage loans. Great enterprises like the Pennsylvania or New York Central terminals in New York, extending over many years of construction, may at any time be embarrassed by an abrupt cloture of financial resources. Forced repeatedly, as in 1903, 1906 and 1907, to the issue of short term notes at high rates of interest, in order to carry out interrupted undertakings, these loans at maturity have been refunded by the sale of long-term bonds under more normal conditions.

The contrast between old-fashioned financing on the basis of a share capital with a small debt, and modern resort to large borrowing was never more strikingly illustrated than in the reorganization of the Chicago & Alton road after 1898. Under a conservative management eight per cent. dividends were paid upon a small capital, and the surplus earnings were used either for improvements or to diminish the bonded debt. Within seven years to 1906, without change of the capital stock, by a complicated series of questionable operations, the bonded debt was expanded from $33,900,000 to $114,600,000.* Leaving details as to the public phase of such transactions aside for future consideration, the important point to note is that by substitution of new low-rate long-term bonds for maturing high rate ones, the increase of fixed charges was still kept within the bounds of net earnings. Interest charges were in fact expanded from $2,790,000 to $3,470,000, or less than one-quarter. In the meantime the total bonded debt had increased more than threefold. The company was safely solvent, to be sure; but all earnings now went to bonds instead of primarily supporting a large share capital. And this share capital once possessing real investment worth was now degraded to a speculative foot ball. This extreme example of bond rather than stock capitalization is valuable as indicating the motives at work in the period of prosperity after 1900. A bond was a bond,—without inquiry as to its character or security. They could be disposed of in unlimited amounts almost without question.

The main reason for the recent relative expansion of bond issues, however, is their intimate relation to the consolidation of once independent properties into great systems. Analysis shows that among these extensive recent borrowings, collateral trust bonds have played a very large part. One railway after another, beginning with the New York Central purchase of the Lake Shore in 1898, has acquired connecting companies by offering its own bonds, secured by deposit of the purchased shares as collateral, in exchange for the stock of the merged company. An enormous volume of such bonds, constituting mortgages, not of real property but of other securities, has been put forth since 1899. About 15 per cent. of the entire indebtedness of active companies in 1906 was collateral trust bonds of this sort, aggregating $1,303,000,000. These securities are of course merely duplication of pre-existing issues and, as already explained, cannot be regarded as expanding the railway capitalization of the country by anything like their face value.

Finally it should be noted that a large proportion of these bond issues since 1901 have been of the so-called convertible sort. Such bonds after a certain specified date, as their name implies, may be exchanged for capital stock at an agreed ratio.

The reasons for the popularity of the convertible bond, revived after more than a generation of disuse, are numerous. But their appeal to speculatively-minded investors, tempted in an overloaded market since the appearance of the great industrial companies by other forms of investment, and their usefulness in permitting gradual growth of share capital through conversion, *pari passu* with the growth of earnings incident to extensive improvements, are sufficient for mention in this connection. Were these convertible bonds to be withdrawn from our account, the apparent over-expansion of railway borrowing in proportion to share issues would be materially reduced. And yet, despite all these considerations, the rapidly augmenting mortgage indebtedness of American railways in recent years deserves serious attention.

Evidences are not wanting that the pendulum is at last once more swinging away from borrowing as a resource for new capital. At the end of 1909 large issues of capital stock have been put forth by such roads as the Pennsylvania, New Haven, New York Central and Chicago & Northwestern. Some of these companies, like the New Haven, were waterlogged with bonds, until they had violated the provisions of Massachusetts laws aiming to keep funded debt less than share capital. Some were so rapidly expanding their earnings that a broader dividend basis was evidently warranted, or was at all events expedient in order not to excite public comment by high rates of earnings upon the existing capital stock. And pending Federal legislation, contemplating an official oversight and control of all capital issues in future, probably was not without effect. Whether such a reaction in favor of stock issues may be expected to assume large proportions, so long as great industrial companies are bidding for new capital in competition with railways, will remain to be seen.

The proportion of stock to bonds in different parts of the country varies widely. But it may be noted in this connection that in 1907 funded debt constituted only 52.3 per cent. of the total in New England. It ranges about the same in the Middle Atlantic states; and is lower only in the trans-Missouri territory; where by reason of the exceptionally low bonded debt of the Great Northern system, mortgage indebtedness is less than 47 per cent. of the total capitalization. In the southern states, on the other hand, the proportion of bonds rises to the extreme of 64.5 per cent. Difference between individual companies are often striking. An abnormally high bonded indebtedness occurs in the following companies, the percentage of capital stock to total capitalization in 1907 being given in each case: For the Atlantic Coast Line, 26; the Louisville & Nashville, 32; the Northern Pacific, 34; Chicago, Burlington & Quincy, 39.6; the Wabash, 43.6; the Baltimore & Ohio, 45; the Illinois Central, 53.8. The opposite extreme of a high proportion of share capital in relation to bonds is exemplified by the Great Northern with 58 per cent., and the Union Pacific with 75 per cent. of its capitalization in the form of stock.

*This is described in detail in an article on Stock Watering in the *Political Science Quarterly*, March, 1911, p. 106 *et seq.*

BROWN'S DISCIPLINE.

A correspondent in the Northwest asks us to inform him about Brown's Discipline—discipline for railway employees without suspension from duty. Fifteen years ago this was a live subject, but latterly we have assumed that this method of managing the punitive part of railway discipline, being in force on many thousands of miles of railway, was pretty well known; but the present inquiry, with others which reach us occasionally, indicate that perhaps there is need of a little more explanation.

The essential features of the system are (1) a record of demerits to be kept against each employee, one demerit being estimated as equal to one day of suspension, as practiced under former conditions where suspension was the punishment for offences too grave to be settled by reprimand and not sufficiently serious to warrant dismissal; (2) a rule by which a certain aggregate of demerits shall subject the employee to dismissal, or at least to the consideration of the question of dismissal, by the superintendent; (3) (on some roads) a clear record for twelve months, or some given number of months, serves to wipe out demerits previously accumulated; (4) bulletins, omitting names of persons, describing cases of negligence or misconduct for which employees have been charged with demerits, these bulletins to be posted at division headquarters for the instruction of all employees.

The Louisville & Nashville, which abolished suspensions many years ago, still keeps up the practice of issuing, for the benefit of employees, an annual circular, giving the results of the operation of the system for twelve months; and from the last annual pamphlet of this kind we quote the following:

Number of employees subject to the system—

Enginemen	1,350
Firemen	1,485
Conductors	1,004
Brakemen	2,233
Baggagemen	128
Porters	136
Yardmen	1,775
Hostlers	129
Operators	1,060
Agent-operators	378
Callers	70
Towermen	43
Draw tenders	20
Section foremen	862
Bridge foremen	104
	10,777

Number of "book suspensions" (491 twice, 203 three, 70 four, 30 five, 4 six, 7 seven, 1 eight and 1 nine times) 4,904

Wages saved to employees—

552	enginemen	11,041 days	$50,425
234	firemen	3,248 days	7,838
571	conductors	10,215 days	37,180
706	brakemen	9,880 days	22,701
32	baggagemen	450 days	1,060
9	porters	95 days	106
794	yardmen	12,040 days	32,337
62	hostlers	1,087 days	2,583
7	switch tenders	80 days	134
2	towermen	40 days	80
61	callers	765 days	970
253	operators	5,075 days	9,294
68	agent-operators	965 days	1,654
99	section foremen	2,125 days	3,693
1	bridge foreman	20 days	56
			$170,117

Number of reprimands	465
Number of discharges, accumulated bad record	9
Number of discharges, other causes	952
Number of credit marks given	18
Number of suspensions cancelled	569

It will be understood that the amounts entered under the heading of wages saved represent the sums which the men would have lost if they had been actually suspended and required to lie off, instead of being subjected simply to a "book suspension."

Following are extracts from the Louisville & Nashville.

DISCIPLINE RULES.

" . . . Disloyalty, dishonesty, intemperance, insubordination, willful negligence, making false reports or statements, and concealing facts concerning matters under investigation, will be dischargeable offenses. . . .

"A discipline record book will be kept in the superintendent's office. . . . There will also be kept in this book a credit account, in which record will be made of excellent conduct, deeds of heroism, loyalty, etc.

"Bulletins will be issued weekly, stating the cause for each case of discipline. . . . Where the company's property is damaged by a failure to observe the rules, or by carelessness, the expense to the company will be shown in the bulletin.

"A book giving a history of each employee from the time he enters the company's service will be maintained. . . .

"A suspension of fifteen days or less charged against an employee will be considered cancelled by a perfect record for one year. A suspension of more than fifteen and not to exceed thirty days will be considered cleared by a perfect record for two years. Suspensions amounting to more than thirty days and not to exceed sixty days will require three years clear record for their cancellation. Suspensions in excess of sixty days, occurring in a period of one year, will call for the special consideration of the board.

"A complimentary bulletin will be issued every twelve months in the prescribed manner, giving employees who have a perfect record for one year a special credit." [Each such employee is named in the bulletin.]

A sample complimentary bulletin lies before us, being that for the Kentucky division for the year ending on October 1 last. In this we find 33 names of enginemen, 49 of firemen, 5 of hostlers, 3 of engine watchmen, 30 of conductors, 70 of station agents and operators, etc.; the list including brakemen, switchmen, train baggagemen, train porters, yard masters, section foremen and carpenter foremen. Discipline of station agents is not recorded in bulletins like that of trainmen, but a notice, similar to a bulletin, is mailed to each agent. Similar action is taken in the case of train despatchers. In this division bulletin a telegrapher, two brakemen, a section foreman and an agent are specially commended, by name, for discovering dangerous defects in moving trains. A broken wheel and a broken truck discovered by the brakemen were in trains other than their own.

On the general question of how "Brown's discipline" is faring in the country as a whole we find no evidence of any marked change since the publication of our brief survey of the subject in our issue of August 20, 1909. This reform makes rather slow and halting progress, like woman suffrage. Indeed a parallel between the two is suggested. In the field of political ethics, as in that of the relation of railway officers to their employees, people seem to find it difficult to reconcile theory and experience. Woman suffrage is making progress in spite of weakness in its doctrines and in spite of the strength of the arguments against it, because its theory is hard to refute. And the abolition of suspensions finds favor for a similar reason. Officers who suspend offenders claim for that plan a high measure of efficiency; but at the same time no one is able to shake the unanswerable dictum that an employee who cannot be disciplined without being deprived of a month's wages is a low-grade man who ought to be dismissed.

The line from Nagoya, Japan, to Hachioji, near Tokyo, has been opened to traffic. This mile is 224 miles long and represents an outlay of $17,500,000. There are 95 tunnels, with a total length of 113,378 ft. The tunnel on the Sasago pass is over two miles long. This is the longest tunnel in Japan. There are 350 bridges on the line with a total length of 24,265 ft. The Torii tunnel is situated 3,189 ft. above sea level, which is the highest point reached on any Japanese railway. There are 506 small bridges and 47 stations on the line. Construction work has been very difficult, as the line traverses mountainous country almost entirely.

TRAIN ACCIDENTS IN OCTOBER.[1]

Following is a list of the most notable train accidents that occurred on the railways of the United States in the month of October, 1911. This record is based on accounts published in local daily newspapers, except in the case of accidents of such magnitude that it seems proper to write to the railway manager for details or for confirmation.

Collisions.

Date.	Road.	Place.	Kind of Accident.	Kind of Train.	Kil'd.	Inj'd.
2.	Atch., T. & S. F.	Crozier.	bc.	P. & F.	1	1
5.	N. Y., N. H. & H.	Great Bar'ton.	xc.	P. & F.	0	4
9.	Boston & M.	Amesbury.	bc.	P. & F.	0	20
10.	Cleve., A. & Col.	Foleys.	rs.	F. & F.	1	0
10.	Balt. & Ohio.	Worthington.	bc.	F. & F.	0	7
13.	Balt. & Ohio.	Chicago.	rc.	F. & F.	2	0
13.	C., C., C. & St. L.	W. Liberty.	rc.	F. & F.	1	0
13.	Penn.	Marble Cliff, O.	rc.	F. & F.	5	6
14.	N. Y., N. H. & Hart.	Berlin.	xc.	F. & P.	2	5
†15.	Missouri Pac.	Gilmore J'c'n.	bc.	P. & F.	7	22
20.	Texas & P.	Marshall.	xc.	P. & F.	1	16
22.	N. Y., N. H. & H.	Hartford.	xc.	P. & F.	0	5
28.	Union Pac.	Rock Springs.	bc.	P. & F.	3	12
29.	Chi. G. West.	Randolph.	rc.	P. & F.	1	3

Derailments.

Date.	Road.	Place.	Cause of derailmt.	Kind of Train.	Kil'd.	Inj'd.
2.	Del., L. & W.	Ray.	b. rail.	P.	0	0
3.	West. Md.	Intersection.	.....	P.	0	16
3.	Atch., T. & S. F.	Laguna.	d. track.	P.	2	4
6.	Wabash	Delphi.	ms.	F.	0	0
8.	Chi., Burl. & Q.	Lingo.	.....	F.	6	0
8.	Atlanta & W. P.	West Point.	unx.	P.	0	2
8.	Cent. Ga.	Buchanan.	malice.	P.	3	25
10.	Seaboard A. L.	Cordele.	.....	P.	0	21
10.	Del., Lack. & W.	Del. Water Gap.	b. wheel.	P.	0	2
†11.	Chi., R. I. & P.	Malvern.	unx.	P.	1	17
12.	Great Nor.	Bellingham.	.....	..	2	3
12.	Cent. Ga.	Fort Valley.	malice.	P.	0	5
17.	N. O., Mobile & C.	McLain.	unx.	P.	1	30
18.	Trinity & B. V.	Normangee.	cow.	F.	1	2
18.	Balt. & Ohio.	Lore City.	b. rail.	P.	0	5
19.	Balt. & Ohio.	Columbus.	b. wheel.	P.	0	2
20.	Knoxv. & B.	Morristown.	d. track.	P.	0	4
20.	P., C., C. & St. L.	Indianapolis.	ms.	P.	1	7
22.	Chi., M. & St. P.	Chicago.	boiler.	F.	0	4
28.	Trinity & B. Val.	Ventura.	boiler.	F.	3	0
28.	Chicago & E. I.	Attica.	unx.	F.	1	3
29.	Cin., H. & Dayton.	Xenia.	unx.	F.	2	0
29.	Fort Worth & D.	Bellevue.	malice.	P.	2	20
30.	Georgia Nor.	Albany.	d. switch.	P.	0	50

The most disastrous accident in this list is the collision which occurred at Gilmore Junction, Neb., on the fifteenth, in which seven persons were killed. This accident was reported in the *Railway Age Gazette* of October 20, page 802. The circumstances were investigated by a coroner's jury, and we have the somewhat unusual result of a verdict in which the main cause of the collision is correctly stated. It will be remembered that, according to the original account, the conductor and engineman of the freight left South Omaha without examining the train register. The coroner's jury finds that, in addition to this, these men perhaps mistook train No. 155, at South Omaha, for No. 105, which was to be met at Gilmore Junction; and "We further find that the mere keeping of a register, as now maintained at South Omaha, is not a sufficient safeguard." The verdict goes on to give further particulars, and in some respects shows a lack of necessary knowledge of railway practices; but everyone who has had experience with train registers, and who has seen the difference (in results) between this means of preventing collisions and the use of an efficient block system, will recognize the force and the exact accuracy of the main statement quoted above.

In the rear collision at Marble Cliff, Ohio, on the thirteenth, an eastbound freight train ran into the rear of a work train, and the victims were laborers riding in the caboose of the work train. This caboose was an ordinary box car and was occupied by 24 men. It was crushed by the engine of the freight and nearly all of the victims suffered wholly from scalding by steam from the engine.

The collision at Berlin, Conn., on the fourteenth was due to a freight train of fifteen cars becoming uncontrollable while being switched at a station which was on a steep grade. The cars had run only about 2,000 ft. when they struck a standing passenger train.

In the collision at Rock Springs, Wyo., on the twenty-eighth a westbound freight train standing on a side track was run into by an eastbound passenger train. This was caused by the misplacement of the switch leading to the side track immediately before the passenger train reached it; this having been done by a brakeman, who, for some unaccountable reason, thought he was throwing another switch.

In the derailment at Malvern, Ark., on the eleventh a passenger was killed, the rear car of the train having been overturned. It is supposed that the derailment was due to a defective frog.

The train derailed at Xenia, Ohio, on the twenty-ninth was a freight train drawn by two engines, and the accident happened on a trestle 50 ft. high. Eighteen cars fell to the bed of the stream below. The engine and thirteen cars passed over the bridge safely.

Electric Accidents.—Of the thirteen accidents to electric cars reported in the newspapers as having occurred in the United States in the month of October, three are reported as resulting fatally. At Rochester, Mich., on the ninth, in a butting collision, two persons were killed and eleven injured. It is said that the collision was due to the wrong indication of the motorman's watch and that the failure of the watch was caused by its having become magnetized. At Philadelphia, Pa., a car was derailed because of excessive speed on a bridge, killing the motorman; and near Steubenville, Ohio, a motorman was killed in a collision in a dense fog.

[1] Abbreviations and marks used in Accident List:
rc, Rear collision——bc, Butting collision——xc, Other collisions——b, Broken——d, Defective——unf, Unforeseen obstruction——unx, Unexplained——derail, Open derailing switch——ms, Misplaced switch——acc. obst., Accidental obstruction——malice, Malicious obstruction of track, etc. ——boiler, Explosion of locomotive on road——fire, Cars burned while running——P. or Pass., Passenger train——F. or Ft., Freight train (including empty engines, work trains, etc.)——Asterisk, Wreck wholly or partly destroyed by fire——Dagger, One or more passengers killed.

Construction work is under way on the first railway in Uruguay for which Americans have obtained a concession. This is the Trans-Uruguayan Railway, and is being built by the Pan-American Transcontinental Railway Company, New York. The main line, which will be about 370 miles long, starts from Colonia, opposite to Buenos Aires, Argentina, and runs almost due north to San Luis, on the northern frontier, where it will be linked up with the Brazilian system. The concession also provides for an extensive scheme of agricultural colonization along the line. The total mileage, including branches, will be 425. Work began in the central section some months ago and is being pushed forward north and south simultaneously with remarkable rapidity, over 1,000 men being employed. Steamers are arriving weekly from New York with large cargoes of railway material, all of American origin; 50,000 tons of rails have already been shipped and the bridges and other structures will call for a further large amount of steel material. Eight hundred thousand ties of Louisiana oak have been purchased, and a steamer recently arrived, bringing a record load of 2,800,000 ft. of lumber. Cement for the station comes from New York. The rolling stock, on a large scale, is being supplied by American firms. About one-half of the line receives a state guaranty of 3½ per cent. on the construction capital, but the remainder is without guaranty. It is hoped to have the first section of 30 miles, from Durazno to Trinidad, open to traffic in December. The entire line will take some years to complete.

Shop Section.

THE publisher of the *Railway Age Gazette* has bought the *American Engineer and Railroad Journal,* the oldest and best monthly railway mechanical paper in the world, and will continue it as an independent publication. Beginning with the January, 1912, issue of the *American Engineer,* the Shop Section of the *Railway Age Gazette* will be transferred to the former paper, and all subscriptions to the Shop Edition of the *Railway Age Gazette* will be filled by substituting the *American Engineer.* The reason for this change is that our work in the interests of shop efficiency and economy has grown to such proportions that the results, when reduced to type, have become too great a burden for any one issue of the *Railway Age Gazette.* Again, our plans for the future with respect to mechanical department problems that must necessarily be covered thoroughly in the columns of the *Railway Age Gazette,* because of their value and interest to officers in other departments, influenced the change. While it will now be necessary for most of the mechanical department officers to read both the *Railway Age Gazette* and the *American Engineer,* the publisher feels that they will be amply repaid. As to the shop foremen and others more directly concerned with railway shop matters, the change will be decidedly for the better. The *American Engineer* will not only continue the prize competitions and other special features of the Shop Section of the *Railway Age Gazette,* but more pages will be added to include news of a kind that has been barred in the past through lack of space.

WE owe an apology to those who contributed to the shop kink competition which closed September 15. The number of kinks which was received was so large and some of them were so similar to kinks which we had previously described that the judges, owing to the pressure of other affairs, have been unable to render a decision in time for announcement in this issue. We trust that this delay will be overlooked on the part of those who are interested.

A SHOP kink competition will be held, closing March 15, 1912. As in the previous competitions of this kind a prize of $50 will be awarded for the best collection of three kinks; more than this number may be submitted allowing the judges to select what they believe to be the best three in each collection. A prize of $25 will be awarded for the second best collection, and other collections that are accepted for publication will be paid for at our regular space rates. Shop kinks may be submitted which are used in any shop, repair yard, or department under the control of the mechanical or motive power officers. Blueprints, drawings, photographs or rough sketches may be used as illustrations.

ALTHOUGH the results in the recent competition on reclaiming scrap material were very satisfactory, yet there were many phases of the question which were not considered, and we have been asked to have another competition on this subject. It will close February 15, 1912, and a prize of $35 will be given for the best article and one of $20 for the second best. Other articles which are accepted will be paid for at our regular space rates. The results of the first competition on this subject were published in our issue of September 1, 1911. A careful study of these articles will undoubtedly suggest ways in which other shop foremen can consider this question to advantage.

TOO much importance cannot be placed on the necessity for not only providing safeguards for dangerous parts of machine tools and other shop equipment but also in training the workmen not to abuse them. George Bradshaw, the author of the article on Shop Safety Appliances and Safety Education, on page 1115 of this issue, has had a wide and extended experience on investigating the causes of accidents on railways and in railway shops. His experience has been that no safety appliance is safe in the hands of an unsafe man. Many preventable accidents are not due so much to the lack of safety devices, as to indifference and negligence on the part of the employees.

THE Paint Shop Practice competition, which closed November 15, was very successful. The first prize of $35 was awarded to C. E. Copp, master painter of the Boston & Maine, Lawrence, Mass., who submitted an article on Paint Shop Practice. The second prize of $20 was awarded to J. H. Pitard, master painter, Mobile & Ohio, Whistler, Ala., who submitted an article on The Protective Value of Paints for Steel Structures. The other competitors were T. J. Hutchinson, foreman painter, Grand Trunk, London, Ont., on Freight Car Painting; A. G. Pancost, draftsman, Elkhart, Ind., on Paint Shop Kinks; N. J. Watts, foreman engine painter, Nashville, Chattanooga & St. Louis, Nashville, Tenn., on Locomotive Painting; and J. H. Whittington, master painter of the Chicago & Alton, Bloomington, Ill., on Coach Cleaning. The first and second prize articles appear in this issue; the others, all of which are of a high grade will be used in later issues.

DO not forget the competition that closes December 15, a full announcement of which was made on page 886 of our issue of November 3. The railways have been forced to practice the strictest economies during the past year and the necessity for increasing the efficiency of the mechanical department by cutting out all waste and lost motion, has been very great. We want a number of good articles telling of improvements which have been made during the year in any shop or department which is interested in the repair and maintenance of locomotives, cars or other mechanical department equipment. It is not necessary that the person who contributes the article should have originated the scheme or improvement which is described, but the author of such an article should in all cases try to give the proper credit for it. As noted in the last Shop Section, the article may include the description of any improvement that has been made in the shops, engine houses, or repair yards, whether in the organization, in the methods of operation, rearrangement of equipment, new devices or shop kinks, the reclaiming of scrap material, or any other feature which may have increased the efficiency of the department in which it is used. A prize of $35 will be awarded for the best article and one of $20 for the second best article. Other articles which are accepted for publication will be paid for at our regular space rates.

MR. SYMONS is correct in his suggestion in a letter in this issue that we did not make one of his statements quite clear in reporting his paper on "The Practical Application of Scientific Management to Railways," which he read before the October meeting of the Franklin Institute. This was purely unintentional on our part. By a rough process of elimination he reduced the number of employees on a railway, to which scientific management might possibly be applied, to one group, the machinists and other shop employees. He then went on to say that scientific management could be applied to only a small proportion of these. If we restrict the meaning of scientific management to include only the

detailed methods which are used by Mr. Taylor, and which are being applied in such establishments as the Taber Manufacturing Company, then Mr. Symons' estimate as to the possible number of railway employees to whom it could be applied is generous. But he goes on to show that the application of scientific management methods on the Santa Fe did not produce the results claimed for it. Scientific management as applied to that road is not at all similar to the methods which are used by Mr. Taylor, but is a modification of them. If we accept the definition of scientific management implied from the first part of Mr. Symons' paper we would be forced to the conclusion that no such thing as scientific management was ever used on the Santa Fe. While the Santa Fe may not have profited very much by the betterment methods, yet there is much in the methods which were used that is good. At any rate it must be admitted that the railways at large have found many things in the Santa Fe practice which they have been able to apply to advantage. Mr. Symons should not overlook the fact that there are no signs of labor trouble in the mechanical department of the Santa Fe, although most of the roads in that territory are now having difficulty in this respect. Mr. Milner was not criticizing Mr. Symons' paper when he spoke of the cost of turning tires, but rather added to or amplified it.

THE RIGID FREIGHT CAR TRUCK.

THE relation between freight car truck design and truck maintenance has never been properly analyzed, and the indefinite and often erroneous opinions on the subject have led to a variety of designs for freight trucks, which differ greatly in essential principles. Some of these are correct in design and, therefore, economical in maintenance and operation, while many others are the opposite. The arch bar truck with the transom bolted or loosely fitted, so universally used in the older and lighter freight equipment, has served as a type or model for the more recent designs with cast steel side frames and loosely connected transoms. The paramount idea governing such design has been that in making truck repairs the bolster could be easily removed and the sides readily disconnected from the transom. This form of construction may be termed the loose-connected truck. The cast or pressed steel side frames have also been used in numerous designs where they are rigidly connected by rivets to the transom, and such designs may be termed rigid trucks.

The latter type of construction was adapted to the ordinary arch bar truck side prior to 1888 in the Thielsen truck, which was used in large numbers by the Burlington and North Western systems, and is now in service under many thousands of their cars. In this truck the arch bars are held square by two vertical channels, and the rigid attachment to the sides has a large rivet area. Theoretically, the rigid truck, which maintains the axles parallel and the wheels normal on a curved track, should cause the least flange friction, and, therefore, less rail and flange wear and less tractive resistance than the loose truck which does not follow the curve with the wheels normal to the rails. The economy of the rigid truck, due to these advantages, should more than offset the savings resulting from the greater convenience and ease of repairs which has always caused shopmen to be partial to the loose truck.

An interesting discussion of these relations will be found in the paper on "Some Experiments on Trucks," by George G. Floyd, read at the September meeting of the Western Railway Club, and partially reproduced in another part of this issue. The author is to be congratulated on his intelligent study of the subject and on the clear manner in which he has discussed a question which is rather difficult to treat in a readable and interesting way. He has fairly considered the merits of each type of truck, and his reasons and statistics, strongly favoring the rigid type, were not controverted by any serious remarks in the club discussion. The paper principally refers to the tests on the friction of freight trucks on curves made by Professor L. E. Endsley at Granite City, Ill., which were fully reported in our issue of March 24, 1911, page 691. The reasons which led up to that test were stated as follows:

The railway literature gave little in the way of information, and there seemed to be no record of experiments or tests along the line under investigation. The railway men consulted were so at variance in their opinions and presented so little tangible and reliable data that this source of information was also disappointing. The facts as far as obtainable pointed strongly to the rigid truck as being the most scientific in construction, but to just what degree it was better, had not been determined. It was, therefore, decided to make an elaborate investigation of the subject by actual test. As many thought it desirable to have a loose connection between the transom and the frame for the purpose of easily replacing the truck bolster on account of failure, it was decided to check up the records of two companies which had sold 1,700,000 truck bolsters in 15 years, under a guarantee of five years' service. It was found that the replacement under the guarantee amounted to only one bolster on 500 cars in five years, or one-tenth of 1 per cent., and the cost of dismantling and reassembling the riveted joint would be less than five cents per car per year, an item so insignificant that the design or construction merely for the purpose of easy exchange of truck bolsters may be regarded as unnecessary. The merits of the two types of trucks, rigid or loose, must, therefore, rest on their tractive qualities and not on the cost of repairs to bolsters. For this reason the tests of the relative friction of such trucks on curves were undertaken.

A number of facts were developed during the test which were not set forth in the published report, and some of these are discussed in the abstract of the paper which we publish in this issue. In the discussions at the September and October meetings of the Western Railway Club, the advocates of the loose truck, although they admitted that it did not track well on curves and caused more friction, claimed that on tangents the reverse was true. The rigid truck was also regarded as dangerous on account of its tendency to derailment. No reference was made to authentic tests sustaining these theories, and these objections to the rigid truck are met more easily by a comparison of freight trucks with passenger and engine trucks. It is a common experience that freight trucks under loaded cars on curves produce a screeching sound with a high note, indicating excessive flange friction, undue wear of wheel flanges and rail, and increased train resistance. This must be due to the fact that the wheels are not normal to the curve, but tend to advance in the direction of a tangent. The operation of passenger trucks on the same curved track is not attended by the noise referred to, and it is fair to conclude that they operate with much less flange friction. All passenger trucks are rigid in the sense used in this discussion, and the constant effort is to maintain them square and rigid by means of knee-irons and wide gusset plates to prevent sharp flanges as far as possible. Six-wheel passenger trucks have a rigid wheel base twice as long as that of the average freight truck, but they move smoothly and quietly on curves and tangents, and if they did not, and tracked like many loose freight trucks, it would not be possible to run passenger trains on the present fast schedules.

Improvements in freight equipment should naturally follow passenger design so far as principle is concerned, and that form which has proved so successful in the severe requirements of passenger service should answer well for freight service. The same argument can be used in meeting the claim that rigid freight trucks are more liable to derailment than loose ones, and a further proof of the incorrectness of the opinion may be found by reference to the service of the four-wheel trucks under the front end of locomotives. These have a wheel base only about 10 in. longer than that of freight trucks, and they are more rigid and held more accurately in line than is possible with a freight truck. The four-wheel engine trucks are used for the very purpose of guiding the locomotive and preventing derailment. The first remedy proposed to prevent the tendency to de-

railment of a locomotive is the application of a four-wheel square and rigid engine truck, and this has come to be regarded as the essential type of truck in the wheel arrangement of passenger locomotives on account of its safety feature with regard to derailment. It is difficult to understand, therefore, why a rigid freight truck should be considered objectionable in this respect. The Granite City tests showed that a truck which is square and rigid, so as to hold the axles radially with the curve, will cause considerably less resistance than a loose truck. As there is in service a very large number of loose freight trucks, and it seems to be the prevailing type under new equipment, and as there is no general agreement among mechanical officers as to which type of truck is best, it is important that an elaborate and serious investigation of this subject should be made by the railway companies.

MECHANICAL ARTICLES DURING NOVEMBER.

THE following articles of special interest to mechanical department readers, and to which Shop Number readers may wish to refer, have appeared in the weekly issues of the *Railway Age Gazette* since that of November 3, 1911:

Mallet Locomotives for the Southern Pacific. The Southern Pacific has recently received 12 Mallet locomotives for use in passenger service on the Sacramento division of the Central Pacific. Each of these will replace two ten-wheel engines, thus avoiding the necessity of double heading passenger trains. The locomotives were described in detail in the issue of November 10, page 952.

Electric Power for Railway Shops. Abstract of a committee report presented at the Chicago meeting of the Association of Railway Electrical Engineers. The best type of electric power is considered for different railway shop uses. November 10, page 955.

Extension Car Step. Description of a device for use on passenger cars in place of the step box. November 10, page 962.

Combustion Chamber and Hollow Brick Wall. An account of tests made on the Central of Georgia with this device, which was designed by F. F. Gaines, superintendent of motive power, and a description of its application to a ten-wheel freight locomotive on the Chicago Great Western. November 10, page 963.

War Department Endorses Scientific Management. A modified form of the Taylor system of shop management has been in use in the Watertown, Mass., arsenal for two years. The article contains abstracts from the report of Brigadier General Crozier, giving a brief outline of the methods used, together with some comments by Secretary of War Stimson. November 10, page 966.

Steel Postal Car Design. The weight of American passenger cars is excessive and should not be exceeded in new designs. Designs should be developed for future postal cars which will furnish maximum strength and stiffness for a given weight. November 17, page 983.

Fireless Locomotive. Description of a steam storage locomotive which has recently been constructed for the National Cash Register Company. November 17, page 990.

Electric Train Lighting. Abstract of an extensive report on this subject which was presented before the recent meeting of the Association of Railway Electrical Engineers. November 17, page 991.

Flexible Metallic Roof for Box Cars. A description of a type of roof which has been designed for greater flexibility than wood and which will have a longer life. November 17, page 997.

External Locomotive Throttle. W. F. Buck, superintendent of motive power of the Atchison, Topeka & Santa Fe, has designed a valve, primarily for use on locomotives equipped with superheaters, which will overcome the disadvantages of the common inside throttle valve. November 17, page 999.

Leakage of Grain from Box Cars. Suggestions are made as to how the loss from this cause, which is a matter for serious concern, may be reduced to a minimum. November 24, page 1040.

Proposed Specification for Postal Cars. This specification has been drawn up by a sub-committee of mechanical officers of the Special Committee on Relations of Railway Operation to Legislation after a conference with a committee from the Post Office Department and the chief engineers of a number of car building companies. The committee will hold a meeting in Washington on December 4 to consider any modifications that may be suggested. November 24, page 1049.

Economies Effected by Mallet Locomotives on the New York Central & Hudson River. The introduction of twenty-six Mallet locomotives has increased the operating capacity of the single track Pennsylvania division 40 per cent. without the construction of a single mile of track. This type of locomotive was adopted for use on this division after an extensive series of tests, which are described in the issue of November 24, page 1054.

Opportunities for Economy on Railways. The first article of a series on this subject by L. C. Fitch, chief engineer of the Chicago Great Western, considers the question of locomotive fuel. November 24, page 1059.

Threatened Strike of Rock Island Shop Employees. A full statement of the points involved in the pending controversy, as issued by the management, is reproduced. November 24, page 1069.

Letters to the Editor.

UTILIZING SCRAP IRON.

OMAHA, Neb., November 24, 1911.

TO THE EDITOR OF THE RAILWAY AGE GAZETTE:

I have read with much interest the article on "A Little More on the Scrap Proposition," by C. C. Leech, which appeared in the *Railway Age Gazette* of November 3. He says: "On one occasion an officer at a large division shop would not allow any small pieces of iron to be kept at the iron rack, because they spoiled its general appearance; consequently much good iron, in lengths varying from 1 to 2 ft., found its way to the scrap bin. Blacksmiths and iron workers are usually very glad to get hold of short pieces for small jobs, especially where the piece-work system is in operation, as much time is saved by not having to carry in and cut off a long bar. While we would not advocate turning the iron rack and its surroundings into a small edition of the scrap yard, it is certainly advisable, and in the interests of economy, to discriminate in favor of the short pieces and not arbitrarily send all to the scrap."

Mr. Leech has very carefully pointed out a fault, but, having suggested no remedy, the question remains unanswered as to whether the cuttings or short pieces should be sent to the scrap bin or be allowed to remain at the rack. I do not believe the correct answer is to be found either in the bin or at the rack. If sent to the scrap bin, we suffer a loss equal to the difference between the market values of merchant bar iron and No. 1 wrought scrap, and if left at the iron house, the inevitable result is, of course, an untidy rack. It is an open secret that blacksmiths, boiler makers and machinists needing a small piece of iron or steel often find it necessary either to go themselves or send their helpers to the iron house to get a bar from the rack, take it to the shop, cut off what they need, weigh it, and return the balance to the rack before they can proceed with their work. In seeking to avoid the necessity of doing this we decided to try placing a small shear adjacent to the iron rack. This we did, and the results have been truly surprising. We obtained a motor driven shear, capable of cutting a flat bar 1 in. x 6 in., or a round bar 2½ in. in diameter. This was installed opposite the unloading track at the iron rack, and was properly housed in a small building erected for the purpose and large enough to accommodate the shear and operator. At this machine is cut all iron of special lengths required for shipment to road points, besides much of the material used in the Omaha shops, not including, however, small rounds for bolts, which are, of course, taken to shop in large quantities and cut on quick action machines. Shopmen wanting small pieces of iron come to the shear-man, who, if there are not short pieces on hand, cuts from a full bar and returns the balance to the rack, provided, of course, that the piece left over is of sufficient length for further general use; otherwise it is put in a special rack provided for that purpose at the rear of the shear-house. The shearman also finds time between jobs to cut up much of the old iron that accumulates from demolished cars, etc.

Instead of locating the shear at the side of the narrow gage track, which would necessitate carrying the iron from the car to the shear, it is placed so that the narrow gage track leads direct to the face of the machine, and bars loaded longitudinally on a push car can be passed endwise from the car to the shear, the jaws of which are the same height from ground as the top of the push car. This avoids lifting, thus enabling one man to handle this work. The narrow gage track leading to opposite side of the shear is depressed in a pit, deep enough to permit the cut iron to drop from the shear through a chute to the push car without handling. Back of the shear-house, where it is out of sight, we have erected a small rack, in length equal to the width of the building and deep enough to accommodate pieces about 2 ft. long, in which all cuttings are stored, properly sorted. This plan not only obviates the necessity for sending short

pieces to the scrap yard, but at the same time enables us to keep our iron rack in a neat and tidy condition, besides affording a ready market for cuttings at their real value, giving quick service to shopmen wanting them, and saving the time, labor and expense of workmen carrying the bars to and from the big shears in the shop.

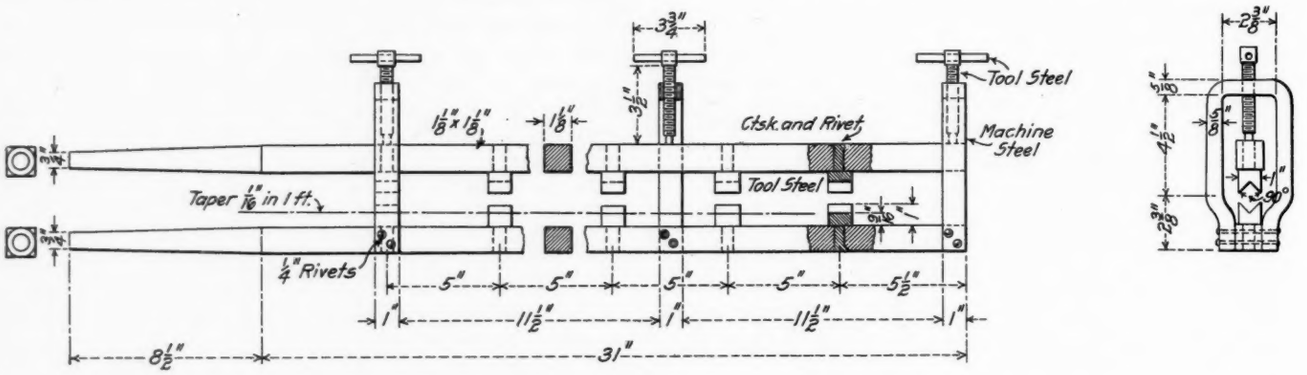
W. S. WILMOTH,
Foreman Iron House, Union Pacific.

CLAMP FOR TEMPERING REAMERS.

TOPEKA, Kansas.

TO THE EDITOR OF THE RAILWAY AGE GAZETTE:

At the last convention of the American Railway Tool Foremen's Association (*Railway Age Gazette,* August 4, 1911, page 224), the question was raised concerning the prevention of long reamers from bending while being tempered. The clamp shown in the accompanying illustration is one that we have used with very good success. The frame reamers for the entire system are made in our shop, their length ranging from 17½ in. to 28½ in.; by using this clamp the number of reamers bent during tempering is only 2 per cent. of the total output. The clamp is 39½ in. long and is provided with five sets of V-blocks spaced 5 in., center to center. These blocks are set in two bars, as shown in the illustration, and are made so that a line through the bottom of the V's has a taper of 1-16 in. in 1 ft., thus allowing for the taper in the reamer. Three screw clamps are used to hold the reamer in the blocks and are placed 12½ in. apart.



Clamp for Holding Long Reamers During the Process of Tempering.

MEMBER OF THE AMERICAN RAILWAY TOOL FOREMEN'S ASS'N.

EFFICIENT MANAGEMENT.

LOS ANGELES, Cal.

TO THE EDITOR OF THE RAILWAY AGE GAZETTE:

To say the railways are not economically managed not only casts a serious reflection on the officials, but really charges inefficiency to 1,500,000 faithful employees. I, therefore, felt that the efficiency engineers were "asleep at the switch," and was deeply interested when the *Railway Age Gazette* opened its pages and offered substantial inducement for special essays on scientific management in the railway shop.* The judges said: "None of the articles submitted are properly discussions of the subject—the Application of Scientific Management to a Railway Shop"—and it looks that way.

The trend of the essays you published is individualism, personality—or, if you please, the man, for as Napoleon put it, "Men are nothing, the man is everything." A man to carry "a message to Garcia"—concentrated energy. Actions speak louder than words—management, executive ability, comprehensive handling of men on the square, scientific management if you will. Actions, deeds, results, are what is wanted—the ratio of operating expenses to gross earnings reduced to a minimum.

On page 56 of the *Railway Age Gazette,* July 7, 1911, are some intensely interesting statistics from which the following are taken:

MAINTENANCE OF EQUIPMENT FOR ELEVEN MONTHS OF FISCAL YEAR, 1911.

Pennsylvania Railroad	$27,079,337
New York Central	15,926,841
Burlington	13,312,406
Atchison, Topeka & Santa Fe	13,052,008
Illinois Central	11,371,543
Southern	8,823,207
Louisville & Nashville	8,737,421
Chicago & North Western	8,569,647
Rock Island	8,372,615
Pennsylvania Company	8,085,491
Great Northern	7,143,032

These figures give one some idea of the magnitude of the expenditure in the railway shops to maintain equipment. As I understand it, the sole object or the question at issue in your competition was to get information as to how to reduce shop expenses permanently; wholesale discharge of shop men reduces pay rolls and saves wear and tear on shop machinery—this has been tried time and again, but has proved a short-sighted policy. You cannot skin your motive power and rolling equipment all the time—"you can't have the penny and the cake."

Locomotives and cars must be kept in repair, and it takes shopmen and engine house men to do it, as well as tools and materials. It is easy for a man sitting on a fence to say how shop expenses should be reduced and the output increased, but the men who work in railway shops know there is a limit to race track stop watches and speedometers. "You can lead a horse to water but you can't compel him to drink." What the men get pay days, whether it be for piecework or day work, that is the "human equation." The ambition, the hope, of the average shop man is for advancement and promotion. An increase in wages to meet the increased cost of living has had a wholesome tendency to make the mass of shop men better satisfied and more efficient.

The writer was a member of a railway shop club in the middle west; it developed a friendly spirit and increased loyalty to the employer. "All work and no play makes Jack a dull boy." The annual picnic in summer and the entertainments once a month in the winter were highly appreciated by all. It was a bracer, and it increased efficiency in the shop.

The interest taken by some roads in the education and training of its shop apprentices to become first-class mechanics is the true application of scientific management to railway shops and it means economy and efficiency in the near future without experimenting with costly theories.

T. B. KEIM.

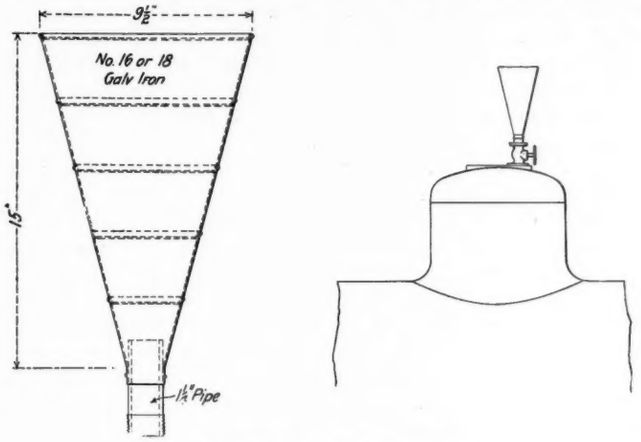
*These essays were published in the issue of July 7, 1911.

BLOW-OFF MUFFLER FOR ENGINE HOUSE.

GLOBE, Arizona.

TO THE EDITOR OF THE RAILWAY AGE GAZETTE:

The accompanying illustration shows a muffler that has been used in an engine house on the Arizona Eastern with very good results. It is placed on the dome of the locomotive and greatly reduces the noise that usually accompanies the blowing off of the steam when it is desired to relieve the pressure from the boiler. It is made of galvanized iron in the shape of a funnel and is fastened at the bottom to a piece of 1¼-in. pipe, which screws into one end of the blow-off valve. The funnel is 15 in. high and has five perforated partitions, as shown in the illustration. The top partition is punched with ⅛-in. holes, and the area of the opening is about 15 to 30 times the area of the 1¼-in. pipe. The intermediate partitions are punched with different size holes; the largest ones, in the bottom partition, are 1 in. in. diameter. However, the total area of the openings gradually increases from the bottom to the top partitions. This device has made it possible for one to talk with a reasonable effort while an engine was blowing off, which without the muffler it would be practically impossible to do. All the material is commercial and the first cost is nominal. JOHN W. LADLOW.



Blow-Off Muffler for Engine House Use.

HYDRAULIC JACKS.

ATLANTIC CITY, N. J., November 24, 1911.

TO THE EDITOR OF THE RAILWAY AGE GAZETTE:

There is no tool in an engine house that is more useful, does harder work, and gets cussed more than the hydraulic jack. If Job had worked in an engine house and had had a rush job requiring a jack, and after dragging it from the tool room and putting it in place under an engine, incidentally bruising a knuckle and having a few drops of hot water drop down the back of his neck, and then found that the jack would not work, he would never have made a reputation for patience. Instead he might have been convicted for manslaughter, if he had met the last man that used the jack at just about that time. Now, the jack probably did work good for the man that had used it before, and when it is taken apart nothing may be found wrong with it. In nearly every case of this kind the trouble is due to dirt or some foreign substance in the jack. If the proper precautions were taken with the jack liquid and in filling the jack, about one-half of the trouble would disappear. Did you ever see men filling a jack away from the tool room? Their hands may be thick with grease and grit, and the head of the jack may be in the same condition; as the filling plug is loosened the grease and dirt pile up around it and as soon as it comes out the dirt drops in. The liquid is then poured in, often without a funnel. The result is that some of the liquid spills alongside of the hole and washes the dirt in with it. I have also seen men overhauling a jack pour the dirty liquid out in a bucket, and after washing out the jack barrel, renewing the leathers and grinding in or renewing the valves, carefully pour back the dirty liquid. The dirt cuts the barrel, leathers and valves and a minute particle of it under a valve will render the jack inoperative.

All this trouble could be avoided if the jack liquid were carefully strained through a funnel having a very fine screen when the jack was being filled. The head of the jack around the filling plug hole should be carefully cleaned before the plug is taken out and the person handling the plug should have his hands clean of loose dirt and grit. Another bad practice is to wipe out the jack barrel with cotton waste when it is being overhauled. The lint of the waste sticks to the side of the barrel and when the jack is put to work it is liable to get under a valve and cause trouble. Such bad practices as leaving jacks in the pit, allowing them to lie lengthwise after being used, and filling them with water, kerosene or any other available liquid are too well known to require special attention being called to them. CHAS. MAIER.

PRACTICAL APPLICATION OF SCIENTIFIC MANAGEMENT TO RAILWAYS.

CHICAGO, November 13, 1911.

TO THE EDITOR OF THE RAILWAY AGE GAZETTE:

The articles in the *Railway Age Gazette* of November 3, 1911, pages 886 and 899, on Efficient Management, have misrepresented the writer's position. You state that I do not define what I mean by the expression "scientific management," and that very few efficiency engineers could agree with me as to my understanding of the term, etc. This is very misleading, and is indicative of either a lack of information on the part of the writer, or a desire to create an erroneous impression.

You say "that the betterment work on the Santa Fe, which I criticize so severely, was based on broader lines than contemplated, etc., and that it is a waste of time to discuss results on the Santa Fe by means of figures from annual reports without thoroughly studying all of the conditions on the road during the time the figures cover, etc." The betterment work on the Santa Fe has not been criticized, and in handling the matter under consideration, I see no reason why it should be.

It is clearly set forth in my paper that answer is being made to testimony before the Interstate Commerce Commission in the recent rate case and to various newspaper and magazine articles with respect to scientific management of our railways, and in which it was claimed that great economies could be effected, and the Santa Fe road was not only cited as an example, but it was claimed that about $5,000,000 was saved to that company. In one item alone of locomotive repairs it was claimed that about $1,250,000 was saved. It was, therefore, quite proper to submit these figures to a test to determine questions of both accuracy and location. The result was just as I have stated, that the figures and statements will not bear analysis, as the high cost of locomotive maintenance in 1904 and 1905 was due to the shopmen's strike; consequently the reduction in cost in 1906 and 1907 would have followed the termination of the trouble, an important factor, on which those who have made claims of such great reductions in cost have so far remained silent, thus creating the erroneous impression that scientific management produced this wonderful result.

As to waste of time discussing certain figures—time cannot be wasted in any analysis of fundamentals, and as the claims of above mentioned economies were based on the railway company's annual reports it was not only proper but *necessary* to an intelligent understanding of the matter to display the figures and discuss them. As to the qualifying conditions mentioned, a glance at the paper will make this clear to any one. In addition to having made a thorough study I may with propriety add, that I was for many years connected with the Santa Fe, and

am thoroughly familiar with the conditions of which I write. These latter elements, however, are not pertinent to this case in which a large part of the reading portion of over 90,000,000 people has been led to believe that with one or possibly two exceptions our railways are inefficiently managed, and as proof of the great economies on one particular road the figures mentioned were given general public circulation. It is therefore perfectly proper for anyone else to submit these same figures to analysis and compare them with the cost on other lines.

Mr. Milner did not point out anything new on the tire question, or about other shop operations in equipment maintenance. These features are clearly and repeatedly declared in language void of ambiguity in my paper, and some 4 or 5 lantern slides were used to illustrate this point. Your statement that Mr. Milner brought out this feature of the fluctuating character of repairs is erroneous, misleading and at variance with the facts. Mr. Milner's remarks were an endorsement of my position on this matter.

You state that my conclusions are that scientific management is applicable to the machinists and other shopmen—243,347, or 16 per cent. of the total number of employees. On what ground this statement is based is beyond my comprehension. By a process of elimination I disposed of all employees by classes until only 16 per cent. were left, before a field was reached for the application of the plan. I said in the most unmistakable language that of over 75 per cent. of these, there are about 5 per cent. employed at work that would lend itself to this plan, and of the remainder about 12 per cent. But to be more than liberal I practically doubled my figures, placing them at 15 per cent. of the machinists and other shopmen to which I added the operators dispensed with, making the following reduction measured in men or money.

POSSIBLE ECONOMIES CONDITIONED.

Men, 32,404 ..... .0021 per cent. of total
In money, $28,658,474..... .0289 per cent. of total

How you can make this 16 per cent. with added comments I am unable to understand, when by no manner of juggling figures could it be made to reach 3 per cent.

It was not the purpose of my paper to define or discuss the multiplicity of features of scientific management, as this has been done by those who advocated its application to railway operation as a means of increasing net revenues in lieu of an increase in freight rates, and reference to the sources of information mentioned in my paper will make this so clear as to leave no room for criticism.

The reading portion of over 90,000,000 people have been told that scientific management would save $1,000,000 per day to our railways, and in pointing to the Santa Fe as an example of economy effected by this plan certain figures were given. It was, therefore, not only proper, but necessary to revise and comment on items of expense pertaining to the operation mentioned; otherwise what are thought to be erroneous statements would have remained unanswered, and the public would remain a false impression.

The Santa Fe is a splendid property, and is managed by experienced officers of well-known ability, who doubtless prefer that the real facts with respect to the extent of, and economy resulting from, the introduction of scientific management on their lines, so thoroughly advertised this year, be made known, particularly the items of locomotive maintenance cost in 1904 to 1907 inclusive, the marked fluctuations of which were due to the shopmen's strike.

The writer is not seeking to discredit in the least the good results that have, and will in future result from the labors of such able and distinguished gentlemen as Harrington Emerson, Frederick W. Taylor, F. B. Gilbreth, Charles L. Day, Chas. Hathaway, Chas. Gantt, and others, in such fields of endeavor as their experience and life work have so ably fitted them. As I have many times employed specialists to aid in the solution of certain problems, likewise served in a similar capacity, I should therefore be able to judge impartially as to the scope of the work ordinarily covered, and the proportion of percentage this bears to the operation or management of a railway.

The entire maintenance of equipment charge is only about 20 per cent. of the operating expenses of our railways, and the probable field for the introduction of the scientific plans, to which my paper is addressed, is only a small portion of this 20 per cent.; probably less than one-quarter. Aside from this restricted field, there is today, and had been for years before this *"scientificana craze"* broke loose, an army of high grade efficiency engineers in the railway field (this includes the principal officers, heads of departments, etc.), many of them boring 4 in. holes with 2 in. augers, as it were; or in other words, showing about 200 per cent. efficiency for the manufacturing plants in their charge. With a few rare exceptions such additions, improvements or changes as might add to their efficiency or earning power are as well known to and better understood by the officers in charge, than they would be to specialists in the particular branches of work affected.

The claim that $1,000,000 per day, or $365,000,000 per year (which has now been raised to $2,000,000 per day, or $730,000,000 per year) can be saved by specialists, is tantamount to a direct charge against the managers of our railways, of the elements of either incompetency and dishonesty, or both, and the purpose of my paper was, as stated, to not only review the matter from a practical standpoint, but to invite such discussion and unprejudiced criticism as to not only make more clear the present public conception of scientific management and its limitations in railway operation, but to also emphasize the fact, that in no other line of human endeavor can there be found higher degrees of efficiency engineering than are now exemplified in the management of our railways. Therefore, the charge that there are now preventable wastes of approximately $730,000,000 per year deserves most emphatic denial, and a fitting rebuke to those responsible for it.

W. E. SYMONS.

BENEFITS DERIVED FROM CONVENTION ATTENDANCE.

November 23, 1911.

TO THE EDITOR OF THE RAILWAY AGE GAZETTE:

You hit on a good subject when you held the competition on the Benefits Derived from Convention Attendance. Unfortunately I have never been allowed to attend a convention of my fellow-craftsmen, although I have felt for some time that I would be able to greatly increase my efficiency by so doing. I like the way in which Mr. Reyer frankly gave his experience, showing that attendance at one convention of the General Foremen's Association had been the primary cause of practically revolutionizing his shop methods, and greatly increasing the efficiency of his shop.

I showed his article to one of my superior officers, and I am very hopeful of being able to go to the convention next year, as it seemed to impress him favorably. We have never had weekly meetings of foremen in our shop, as was suggested by Mr. Hall. The idea appealed to me, and I have had two such meetings of my foremen since the receipt of your issue of November 3. The effect has been very good. A number of little annoyances have been eliminated, which have bothered us for some time. When the bunch of us got together and these matters came up, we found it was comparatively easy to eliminate them by securing the co-operation of the various department foremen. The meetings seemed to brace the boys up in good shape and they are taking a great deal more interest in their work than they did before.

I have been wondering whether there would be quite so much talking about the need of efficiency men if we foremen were sent out occasionally to visit other shops and see what they were doing, thus broadening our viewpoint and giving us an opportunity to make improvements in our own plant.

A GENERAL FOREMAN.

PAINT SHOP PRACTICE.*

BY C. E. COPP,
Master Painter, Boston & Maine, Lawrence, Mass.

Car painting is only a part of a whole that is planned and executed at a plant constructed for the purpose of repairing railway equipment. The master painter is an important unit in the sum total, if he does his duty; he is indispensible, and it behooves him to perform his duties well. His importance should appear in the character and promptness of his work. He should classify it as much as possible and select his men so as to obtain the best efficiency. The painter's materials should come to him as nearly ready-prepared as possible. The paint factory has the facilities and space for the proper performance of this work that railway shops seldom afford. Also machine-mixed goods are better than the hand-stirred, to say nothing of fine grinding in suitable mills.

The real success in coach painting, so far as the exterior goes, lies in the priming and surfacing used. There are successful systems of primers and surfacers on the market from which experimental and exposure tests will reveal those best adapted for use, if one cannot put full confidence in the statements of reputable firms that handle them. The choice of these being made, the foreman painter's duty is to see that they are correctly applied and finished; the directions that accompany them are generally sufficient, barring variations in special cases. The old lead system that was made in the shop has merit, but it is too slow for the present time, and its use is also a menace to the health of the employees for the dust that is made while sandpapering is drawn into the lungs or through the pores of the hands. The use of lead should be limited to putty and its addition to prepared priming which gives it greater adhesion. The surface being finished, whether by block pumice rubbing or by sandpaper surfacers, the car is ready for the car-body color. Put sufficient outside finishing varnish into the color to give it binding property, but not enough to cause the gold to stick when gilding the letters or the varnish to crawl; then thin it to a working consistency with pure spirits of turpentine or a good substitute of turpentine, and apply with a 3- in. or 4-in. rubber-set brush. Two coats will make a good job. When the lettering and the stripping are finished it is better to allow it to stand until the next day, if there is time, in order that the gilding shall be hard enough to withstand dusting and varnishing. Then apply three good coats of outside finishing varnish, allowing at least a day between the coats—two days would be better if it is possible to take the time. It is better not to use any rubbing varnish on the exterior, as it is too hard drying and is apt to check and perish quicker than where an all-finishing job is done.

Enamels should be extensively used in car painting. By this is meant a union of color and varnish that is more properly called a "varnish color." This saves the operation of applying the color separately. It may be successfully applied on trucks, steps, platforms and clear-stories of all classes of passenger cars when they are properly primed and have a coated foundation. It should also be used in a similar manner on the interior of mail and caboose cars, using white for the ceilings of the mail cars, and whatever suits the fancy for the ceilings of the caboose cars. Enamels can also be used in part, or for the whole of baggage and milk car interiors. Milk car exteriors may profitably be painted in a combination of oil and enamel, without using any finishing coat of varnish, and the lettering may be done in gold-colored paint of the same nature. If finished in this way on a lead and oil foundation a durable job will be obtained; and if the car should not reach a shop again for 4 or 5 years there would be no chipping or peeling.

The iron work of passenger equipment, especially that above the platforms, should not be left to the last and finished in a hurry with quick-drying materials, as they will soon perish and peel, with rust as the inevitable consequence. This part of the work should be primed in advance with a suitable primer before being finished with the durable black varnish that is to follow. For this purpose avoid asphaltums and use carbon blacks ground in finishing varnish. Passenger car interiors are sometimes varnished too often, when in the shop for annual repairs. The bad results from this practice are seen in an accumulation of grime under the varnish, and worse still, it will crack into an "alligator finish" which can only be removed by a varnish remover applied at great cost. An interior properly finished when new ought to run in service, with regular cleaning, 3 or 4 years without revarnishing, and as long between subsequent varnishings. By a properly finished interior is meant one filled with a good paste filler, and then given one coat of shellac which is lightly sandpapered and followed with 2 or 3 coats, one over the other without rubbing, of a good elastic outside rubbing varnish. When hard enough, this is rubbed down to a level surface with pumice and water and is brightened up with some good renovator oil and then wiped dry.

FREIGHT CAR PAINTING.

Where paint sprayers are used for this class of work, the painting should be done in the yard or in separately built sheds, as the vapor from the machines is obnoxious to the workmen and makes an untidy shop, covering the windows so that a varnish remover is necessary to clean them. This method was in general use on our road until 1903 when, after returning from a visit to the shops of the Grand Trunk at London, Ont., I tried their method. A special 8-in. whitewash brush, made heavier for this purpose, was used with a handle about the length of a broom handle. One man would take the top-stretch, standing on staging, and another man the bottom-stretch, standing on the ground. With this system it was found that the work could be done better and faster than with the paint sprayer.

In the summer of 1909 a number of box cars were set aside to be painted, at a time when there were no passenger cars in the shop. In doing this work I made some time tests of the above mentioned method. The paint shop held about 18 or 20 cars, and as many more were placed in the yard in another shop. With eight men on this work, fourteen cars were finished per day. We gave them two coats each and stenciled them according to the M. C. B. standards. One man would easily paint four large cars per day with one coat, including the roofs. We did not paint the Fox trucks, although we could have included them, but we did stencil the journal sizes on them. Two crews of two men each would stencil seven cars per crew per day and clean their stencils when done. Even then, they would have time to help on the general painting. The work was all performed on piece-work rates and was kept account of by tying red tags to the journal box covers. On these tags were written the number of the car, capacity, weight, height, width, inside length, etc., and when the stencilers completed the day's work the tags were collected and turned into the office where the piece-work earnings were calculated. In every case these tags were used in making reports so that all mistakes were eliminated, the tags being kept for reference. This saved a lot of book memorandum records and worked like a charm.

*Awarded the first prize of $35 in the competition on Paint Shop Practice which closed November 15, 1911.

The system of Belgian state railways in 1904 comprised 2,422 miles; and in 1902, 2,593 miles. The increase of 171 miles was brought about largely by the purchase of 98 miles of line owned by the Western Flanders Company, and the 14 miles of line owned by the Tremonde-St. Nicolas Company. The steady increase in traffic necessitated extensive enlargements of freight terminals and of yards. Train loads could not be increased, nor could heavier rolling stock be operated without laying heavier rails.

MACHINE AND ERECTING SHOP KINKS.*

BY C. C. LEECH,
Foreman, Pennsylvania Railroad, Buffalo, N. Y.

LATHE CHUCK FOR METALLIC PACKING.

The details of a chuck for holding metallic packing, when it is being bored to size in a lathe, are shown in Fig. 1. The body *A* is made of soft steel and has a tapered shank which fits in the lathe spindle. The part *B* is bored out to take the collets *C*, which are made to slip in easily. The collet is held firmly in place by the standard nut *D*, which fits on the threaded portion of the body. This nut must, of course, be bored out large enough to clear the boring tool for the largest diameter of packing that is to be handled in the chuck. The recess or counterbore in the body *B*, which is 1¼ in. deep and 4 in. in diameter, allows room for the tool when it passes through the packing. In addition to holding the collet in place the nut *D* also has a bearing on the face of the packing, thus holding it tight while it is being bored. Any number of collets may be provided to suit the different classes of piston rod and valve stem packing. When the packing is too thin for the nut *D* to have a bearing on it the plate *E* is placed in the nut before screwing it on the body. This chuck will be found particularly advantageous when the different classes of packing are made in large quantities and the hole is left small in order that it may be bored to the correct diameter of the piston rod or valve stem when it becomes necessary to use it.

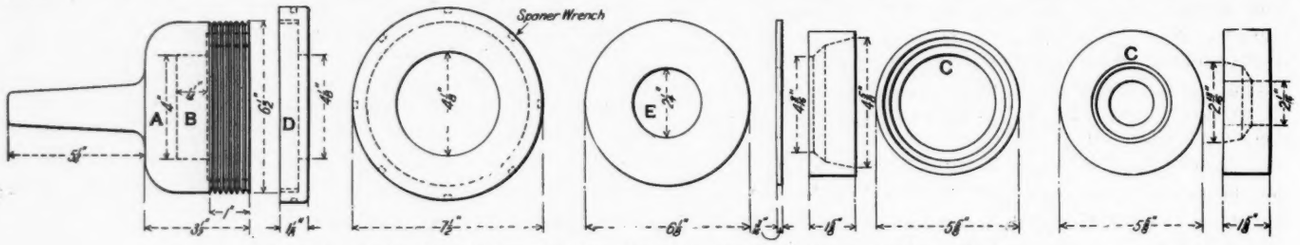


Fig. 1—Lathe Chuck for Holding Metallic Packing When Boring to Size.

CHUCKING BLOCKS FOR VERTICAL BORING MILL OR PLANER.

The chucking blocks shown in Fig. 2 are made of cast iron and will be found convenient for use on vertical boring mills or planers. They can be made in sets of 4, 6, or 8, and of varying sizes to meet the requirements.

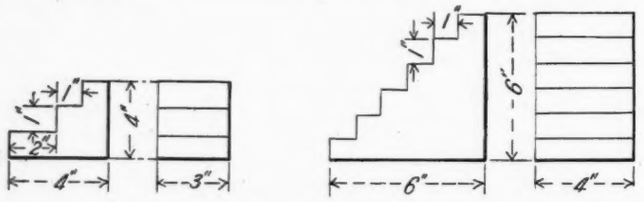


Fig. 2—Chucking Blocks for Vertical Boring Mill or Planer.

ROD BRASS CLAMPS.

The clamps shown in Fig. 3 are convenient for holding the parts of old rod brasses together when it is necessary to rebore them in a lathe, and also for new work. Considerable time and labor may be saved by having a number of sets of these clamps in the tool room suitable for the various classes of main rod brasses which are in use. With these clamps it is not necessary to sweat the parts of the brass together.

ECCENTRIC BLADE BENDER.

The eccentric blade bender shown in Fig. 4 is different from any of those which have thus far been described in the *Railway Age Gazette*. The part *A* is forged to the shape shown, and is fitted with the clamps *B* at each end. The purpose of these clamps is to support the part *A* when it is hung on the eccentric rod, so that it may easily be adjusted to the proper position for making the bend or off-set. An ordinary horse shoe clamp is used for bending the rod. The part *A* may easily be moved along the rod.

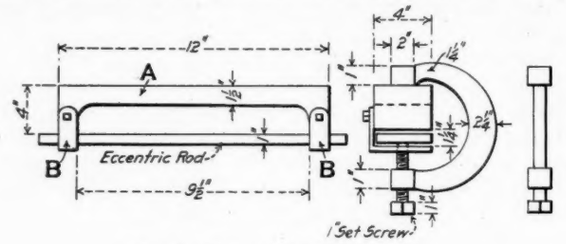


Fig. 4—Eccentric Rod Bender.

FORMING TOOL FOR METALLIC PACKING.

The forming tool for metallic packing, which is shown in Fig. 5, is used for finishing the packing after it has been roughed off. The shank of the tool is made to fit the tailstock of the lathe. It is fed against the casting, smoothing it up and finishing it to

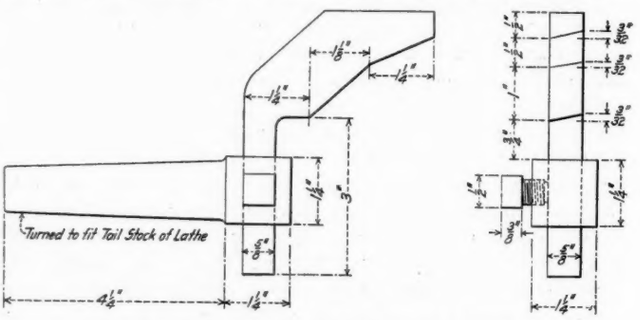


Fig. 5—Finishing Tool for Metallic Packing.

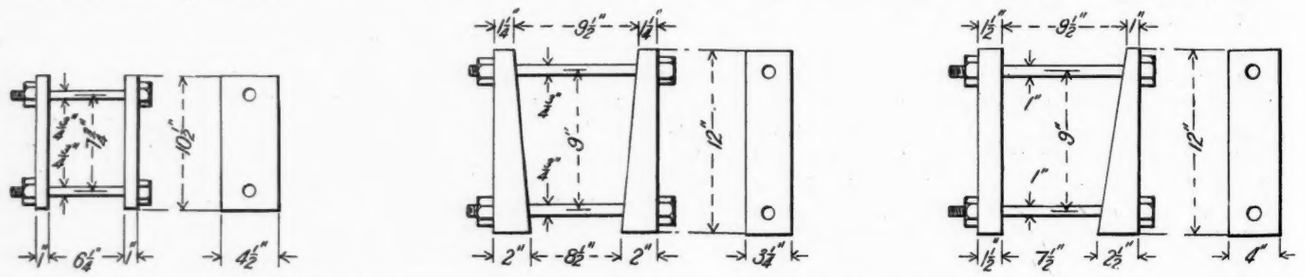


Fig. 3—Clamps for Holding Rod Brasses Together When Reboring.

*These kinks are part of a collection which was submitted by Mr. Leech in the shop kink competition that closed May 15, 1911, and in which he was awarded the first prize of $50.

the correct contour. The cutter may be adjusted in or out and is securely held in place by the set screw. One cutter is required for the piston rod packing and one for the valve stem packing.

CHUCK FOR VERTICAL BORING MILL.

A simple and effective chuck for holding tires and other work for boring and turning on a vertical boring mill is shown in Fig. 6. The body of the chuck is of cast iron and has a tongue

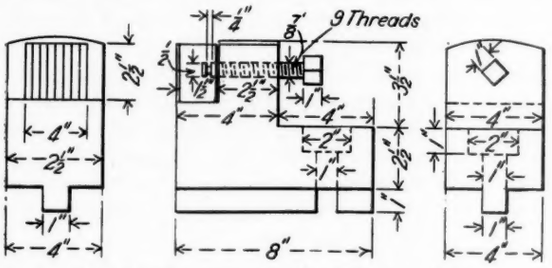


Fig. 6—Chuck for Vertical Boring Mill.

which fits in the slots on the table of the mill. Only one bolt is used to fasten each chuck to the table. The jaw is of hardened tool steel and has grooves cut in the face which grip the work. The jaw is forced against the work by the ⅞ in. steel set screw.

TIRE HEATER.

A cheap and effective tire heater, where gas is used, is shown in Fig. 7. The circular portion is made of ¾ in pipe, with ⅛ in. holes, spaced 2 in. apart, on the side toward the tire. There should be a sufficient number of these circular parts to take care of the different diameters of tires; it is not a good plan to open the pipe out for use with larger tires than it was intended for,

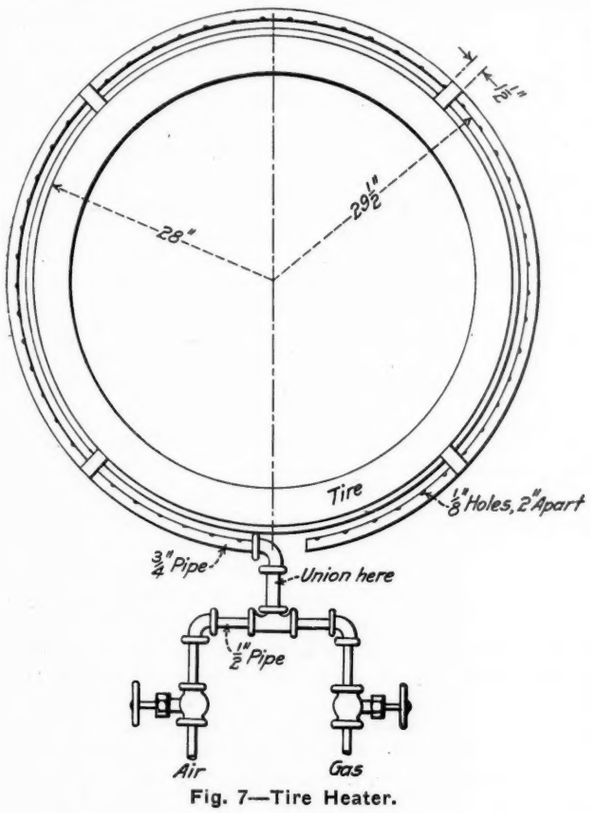


Fig. 7—Tire Heater.

as bending it back and forth soon causes it to break. The union which connects the air and gas pipes allows the ring to be detached and changed. Gas is used at a pressure of about 45 lbs. per sq. in. and air at about 75 lbs. per sq. in. In operation the piping which connects to the ring is at right angles to the position shown on the drawing.

TOOL STEEL.*

BY W. B. SULLIVAN.

Merely having a micrometer in the shop does not mean duplicate size tools; and merely having a pyrometer in the hardening room and a sclerescope in the testing room does not mean duplication of temperature and hardness. Experience in the use of these instruments, and their constant calibration and use, are the all important factors in the production of high efficiency tools. I cannot emphasize too strongly the importance of the constant checking up and the daily use of the above mentioned instruments. A few years ago, in about ninety cases out of a hundred, any lack of uniformity in the service rendered by the tools was attributed to the steel. Recent discoveries have proved that we have been working pretty much in the dark, and that 95 per cent. of the failures resulted from lack of knowledge on the subject of proper treating temperatures. It is a fact that degrees of temperature can only be approximated by the eye, and at best the *eye* method is guess work. This statement is made after years of experience in dealing with men who have had from 5 to 25 years of service at furnaces running the full range of heats. I have had five men vary 300 deg. on one furnace in endeavoring to take the temperature with the eye.

When 90 per cent. carbon steel is subjected to a uniformly increasing temperature, say from 100 deg. upward, ferrite and pearlite remain practically unchanged until the temperature reaches the neighborhood of 1,360 deg. Fahr. With increasing temperature at approximately this point they suddenly begin to decompose. When this change or decomposition begins to take place, the piece does not rise in temperature with the furnace, but lags behind for an interval, then accelerates slightly until approximately 1,460 deg. Fahr. is reached, or until the decomposition is completed, when it assumes the normal temperature of the furnace.

As heat is required to decompose the original minerals in the soft or annealed steel, the material absorbs a sufficient amount of heat to complete this change. This change is called the critical point. In this operation we have lost all traces of the original mineral condition, that is, ferrite and pearlite have both been decomposed and we have evolved what is known as martensite. By quenching at this point, the martensetic condition is preserved and the metal will be found hard and brittle. This martensite in a carbon steel is very sensitive to heat and decomposes very rapidly when heated, and if heated high enough is entirely decomposed, and the original ferrite and pearlite condition restored. It is, therefore, obvious that to anneal a piece of steel we should heat only high enough to decompose the martensite. If the material be annealed at a temperature where martensite is formed, it will be found to machine hard, as it will contain a portion of the hardening element. By a judicious application of heat we can obtain any combination of the three minerals. These changes take place at definite temperatures consistent with the material and the temperatures are determined by critical-point instruments.

Tools when properly handled should first be heated carefully and uniformly to the proper temperature and quenched. Having the complete structure developed, the effect of further heating only tends to produce overheating, and decarbonization; therefore, realizing that further heat is not only unnecessary, but if carried any considerable length, very harmful, we fix the point of temperature at which to treat and work as closely to it as practicable. (Then follows a description of the use and the calibration of pyrometers.)

Hardness.—As a general rule, the higher the temperature of the cooling medium, the lower the degrees of hardness. For this reason, it is advisable to maintain the temperature of the bath as nearly uniform as possible for a given piece; although it

*Abstract of a paper read before the New York Railroad Club, November 17, 1911.

will be found expedient to vary the temperature of the cooling medium for some forms of cutters, dies, etc. Cooling baths are of various types. Brine, water, oils of different character, lead, air, etc. As water extracts heat more rapidly than oil, a piece of tool steel, quenched in water will be harder than one quenched in oil; tool steel quenched in air will have a certain amount of hardness, but will be much softer than if cooled in oil.

There are several instruments that may be used successfully in determining hardness. The sclerescope method is based on the free fall in air of a ball of known weight, a known distance. There is a diamond point inserted in the ball, which point strikes the object or specimen being tested; the rebound, as indicated by a scale on the instrument, is the measure of the hardness. Our experience has been that this instrument has its greatest application to values of 75 and over, and great care must be taken in analyzing the results obtained by it, for different materials seem to give results characteristic of that material, and have no definite relation to hardness as shown by other materials.

The Brinell method is based upon sinking a ball into the object or specimen to be tested. A load of 3,000 kilograms is applied to a 10 mm. hardened ball, and the volume of the impression as indicated by measuring the diameter is the measure of hardness. This instrument cannot often be used on finished surfaces, as it leaves a permanent deformation. Its greatest application is found in values of 475 or under. Attempts have been made to give a factor for changing Brinell hardness values into sclerescope values, but our experience has been that different factors must be used for each grade of material, and even different factors when the same grade is hardened in oil and water.

If we were to harden a number of pieces of the same carbon content from the proper temperature, cooling them properly in water or brine, upon measuring their hardness there would be little variation found. If some of these were drawn at 300 deg., some 325 deg., some 350 deg., and so on up to 600 deg. Fahr., the hardness would be found to decrease proportionately to the amount of heat applied. If these pieces were tools sent out for test, and some held up and some did not, it would be an easy matter to determine how much leeway we had so far as physical condition was concerned. The question to be determined is how much toughness is required to hold the tool together?

After hardening at the definite temperature the amount of hardness required for the tool can be determined by drawing in oil, lead or saltpeter to a definite temperature and then measuring the hardness after cooling. An accurate record of the temperature and hardness, together with the performance of the tool, should be kept and note made as to how the tool failed and why. A careful analysis of these records will enable us to use such temperature in drawing and subsequent hardness values, as will largely eliminate failures and increase tool efficiency wonderfully.

Ten punches were treated in an open fire and drawn to a color. From their appearance all indicated reasonably uniform drawing. The hardness of these punches varied from 55 to 85 sclerescope test. The service test proved that for this class of work those having a hardness of over 80 were brittle and would not stand; three being over 80 broke after punching a few holes. Five having an average hardness of 77 were in good condition after 500 holes. Two having a hardness from 55 to 64 upset or bent after a very few holes. In this case the diameter of the punch was 13/16 in., and the plates 1¼ in. thick. Five punches were hardened and drawn to a definite temperature. All of these showed a hardness of 77/80 and all punched 500 holes and were in perfect condition.

A die block making an unusually hard forging was hardened and drawn to show a sclerescope hardness of 75; it made 66 forgings when it failed by cracking. Another block of the same grade of material was hardened and drawn to show a value of 70; after it made 600 forgings, it failed in the same manner as the first block. A third block of the same material was heated and drawn to a hardness value of 65, and was in fine condition after making 13,000 forgings.

From what has been set forth, it is evident that to get the best results from tool steels a certain amount of apparatus is necessary, and in the case of railway work it would seem to point to a central plant for the manufacture and hardening of tools. This would necessarily cause some inconvenience, but it would seem that this inconvenience would be more than offset by the results obtained, for it must be admitted that economy consists in getting out of the steel all there is in it.

DISCUSSION.

There was a general consensus of opinion throughout the discussion that it is of the utmost importance that the closest attention should be paid to the scientific treatment of steel in the hardening and tempering, and it was claimed that American mills are leading the world in the use of scientific methods in the manufacture of their product.

In working along these lines it is necessary that we should be able to express our results in numbers, in units of measurement that are capable of being accurately interpreted and which will form the basis for a reproduction. The indefinite use of determining temperatures and expressing them as light or dull cherry red or straw color must be discarded. We hear much of the "body" of steel, but the term is usually meaningless, except as indicative of the excellence of the steel that one is solicited to buy. In reality the expression may be summed up to mean the total of care that has been exercised in the selection of the materials and the work that has been put upon them in the making of the steel.

It was especially urged by speakers, as well as by the author of the paper, that the pyrometer should be used for the determination of the temperatures of heat treatment; not with the expectation that any one would use the method, but with the hope that some one may. It is believed that it can be used economically in the ordinary shop for tool dressing, just as it is used elsewhere in the manufacture of articles, large and small, which are so handled economically upon a commercial scale. This does not mean that the services of an expert tool dresser should be dispensed with, for just the contrary is the case, because of the many elements that are influential factors in the preparation of a tool for service, which include the chemical analysis, the method of cooling and the temper desired.

Further, in this heat treatment all tools should be quenched in oil, as better results may be obtained with oil than with water. It is impossible to give the temperatures at which the work should be done, but this can readily be obtained by experiment. It is a matter that will vary with the methods of cooling. For example, the temperature of the steel should be quite different if the metal is to be plunged into a powerful stream of water, so strong as to force itself into direct contact with the steel and so prevent the spheroidal condition, than if it were to be plunged into a quiet bath where the spheroidal condition may exist and the cooling thus take place more slowly, while the temperature of the bath may cause a still further modification of the proper temperature of the metal.

To controvert these claims for the scientific pyrometric treatment of tool steels, an instance was cited of a test of steel that had been made, in which the metal was treated by the blacksmith, and it was thought that good results had been obtained. The maker examined the tool and declared it spoiled and proceeded to harden and temper it himself, and failed to get anything like as good results; while it not infrequently happened that the blacksmith would dress a tool that would turn 45 driving wheel tires with one grinding which was considered pretty good.

It was also stated, in connection with the matter, that a pyrometer was not needed to determine the quenching temperature, because it had been found that at 2,250 deg. Fahr., a sort of feather edge jumped up on the angles of the tool. This is plainly visible in the clear atmosphere of a furnace, but probably could not be seen in the open fire of a forge.

The cutting qualities or durability of tools was discussed, and it was shown how there was a certain temperature for each and every grade of steel and degree of temper at which the tool would show the greatest durability from the standpoint of the rate of dulling of the edge. Attention was called to the well-known fact that where a tool dulls rapidly on light work, its durability can frequently be increased by increasing the speed. Further, that on finishing cuts, where a carbon steel will outlast a high speed steel, the latter will become the more durable if the speed is increased so that the tool will be heated to its crucial temperature at which the durability is greatest. These statements are checked by the well-known rapid dulling of cold tools and that this durability can be increased by warming them in the fire before putting them to work. And finally, this is emphasized by the fact that because one grade of steel has proved to be very efficient in the cutting of steel or iron, it may not be at all suited to the cutting of brass, and this regardless of the shape of the tool which, of course, cannot be taken into account.

Attention was called to the use of titanium as a purgative for steel, and it was stated by one speaker that he had a list of a dozen firms of steel makers, makers of tool steels, who were regularly using titanium, but that they were very secretive as to what they did with it. It was suspected that some of it at least was used in connection with the making of tool steels, but there is no definite knowledge abroad as to this. It would be interesting if they would own up to what they were doing, but it was not at all probable that they would.

As to the extent to which high speed steel is being used in this country, it is rapidly increasing. It was asserted that, in one locomotive shop, at least 95 per cent. of the tool steel used was of the high speed variety, and that the use of carbon steel is rapidly disappearing, except for brass finishing. If an attempt were made to get a workman to use carbon steel, who had become accustomed to the high speed, there would at once be great opposition to the change. The major portion of this steel is imported, though the quality of the American goods is fully equal to or superior to any made abroad.

It was urged that Americans take it upon themselves to imitate the Germans more closely, who are patriotic in their patronage of home industries. This was, too, of interest to the railways in the matter of freights, for though the actual tonnage of tool steel might be small, it was found that for every ton of such material shipped about 6 tons of supplies were needed.

As to uniformity of product, there should be no trouble in securing that; and, indeed, where an electric furnace is used it should be impossible to make a bar that was not uniform from end to end.

We were urged to imitate the Germans in their methods, and though they might have disregarded advanced methods 20 years ago, that was far from being the case at present. One speaker considered them far in advance of us, and thought that the Krupp works owed the greater part of its success to its great physical laboratory, where 500 assistants are employed, most of whom possess a doctor's degree. Here 20,000 chromium determinations are made every year and 480 carbon tests every morning. They make fatigue tests of all metal and are not content with merely dropping a weight on an axle, but make a large number of repeated stresses until the material fails. The same holds true regarding microscopic analyses. So when asked what percentage of their guns burst or rails broke, the superintendent said: "We never have a gun burst or a rail break." It is this tremendous reality of things in the German mind that is responsible for the advances made by that country in recent years.

In closing Mr. Sullivan stated that to get comparative results with the scleroscope tests for hardness, it was necessary to use similar specimens, and that it was his custom to use them about ¾ in. square. But even then, tests between different grades of steel were not strictly comparable.

ENGINE HOUSE KINKS.

BY THOMAS NAYLOR,
Engine House Foreman, Chicago, St. Paul, Minneapolis & Omaha, St. James, Minn.

SPRING PULLER.

The spring puller shown in Fig. 1 has proved very useful for removing trailer truck springs. It consists of a right and left hand threaded screw, one end of which fits in an arm fastened to the rails, as shown, and the other in an adjustable

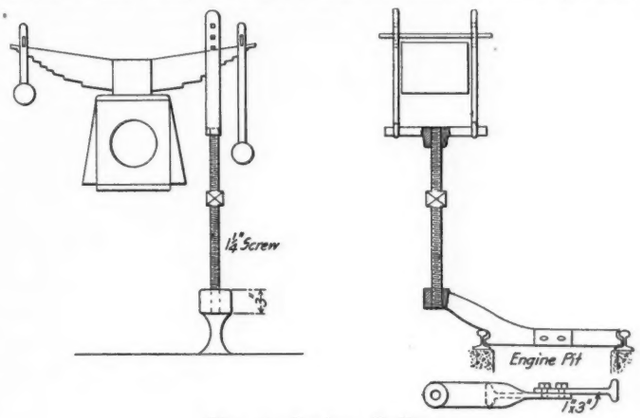


Fig. 1—Spring Puller.

yoke that is placed around the end of the trailer spring. The spring is pulled down by turning the screw. The arm that is held between the rails is easily adjusted by loosening the stud bolts which hold the two parts together. The slotted holes in one of the members allow sufficient play.

TRUCK FOR REMOVING TENDER WHEELS.

The truck shown in Fig. 2 is used for removing tender and engine truck wheels. With it the wheels may easily be moved in and out from under an engine or tender. The crotch of the truck is of wood and fits under the journal. One end of

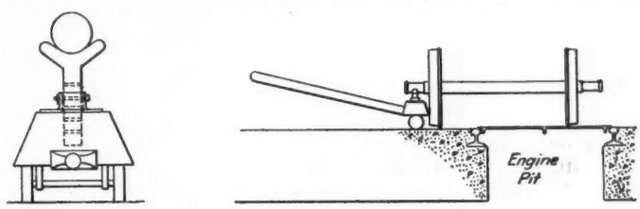


Fig. 2—Truck for Removing Tender Wheels.

the axle is lifted by pressing down on the handle of the truck and the wheels are removed by sliding one wheel on the plate that extends across the pit. One man is able with this device to slide a pair of wheels under a tender in a few minutes, and the liability of accidents is reduced.

CLAMP FOR CRACKED STEAM CHEST.

The clamp shown in Fig. 3 may be made to fit almost any steam chest of the slide valve type. A bar to extend across the front of the chest is made of 2½ in. x 1 in. iron, being en-

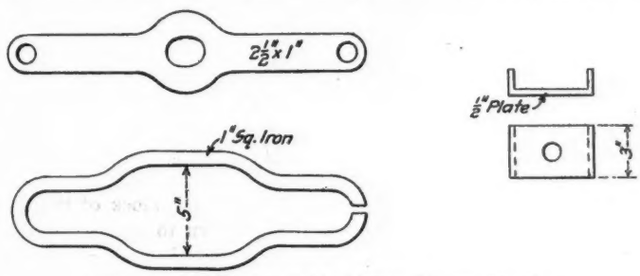


Fig. 3—Clamp for Slide Valve Steam Chest.

larged and cut out at the center, if necessary to clear any projection. The bar for the back end of the chest is made of 1 in. square iron in the shape shown, so as to allow it to be sprung over the valve rod and to clear the valve stem gland, etc. Two ½-in. plates, as shown, are fitted over each end of this bar. These are connected to the bar extending across the front of the chest by two large bolts. The device is easy to make, and has been used very effectually. If the crack should be on the end of the chest the same clamps may be used by bending one of the bolts to pass under the valve stem.

DON'TS FOR ENGINE HOUSE FOREMEN.

BY ANDREW C. LOUDON.

Don't get excited. If the yardmaster becomes so, it is no reason why you should follow suit. Keep cool and remember that he has his troubles. It doesn't matter to him personally if you don't turn the power out quickly. It is the superintendent and trainmaster that are after him, as well as after you. Getting excited won't get you over difficulties. The engine house foreman is a man who requires a cool head at all times.

Don't let the power stand outside after arrival. The quicker the engines enter the engine house, the quicker they will be ready to leave it. Organize your outside staff so that incoming engines will be handled expeditiously at the coaling plant and over the ash pit into the house.

Don't run around trying to oversee every detail of the engine repairs. Let your gang foremen look after the detail work, make them responsible for it, and if you haven't enough gang foremen get after the master mechanic till you get them. If you appoint the right men they will save their wages in a short time.

Don't let an engine pass through your shop without having a complete record of arrival and departure times, etc., and of the work done. See that your shopmen keep in touch with the office staff and give the latter whatever information is called for. Such records may be valuable in getting the company, your superior officers and yourself out of a hole.

Dont' try to put on airs with your men. You will gain no respect by it—rather the reverse.

Don't treat your men like a lot of animals. Remember they are human and have feelings. It is just as easy to give orders in a kind as in a rough manner, and they will be more quickly and willingly obeyed.

Don't be ashamed to admit you have made a mistake. To err is human. Let the memory of your mistake keep you out of the same and similar mistakes in the future.

Don't ridicule your men when they come to you with new ideas. You are not infallible and your methods can probably be improved upon. If a man has a good idea give him an opportunity to prove its value. It may be a money saver.

Don't let the organization slip out of your hands. Keep your men friendly, but remember there is a point beyond which the dignity of your position should prevent their going.

Don't let one part of your staff work against another. They are all working for the same company and should work to the same end. Team work is necessary. If there is lack of it, and shifting the principal offenders about will not overcome it, get rid of them. Otherwise they will undermine your organization.

Don't hesitate about administering discipline impartially. If members of your staff do not live up to the standards which you set, tell them about it plainly. On the other hand,

Don't nag. If you do you will soon have a discontented, sulky lot of men.

Don't let the engineman running out of your terminal carry a 5-gal. can of valve oil, three or four monkey wrenches, about 75 lbs. of waste and two or three extra hand lanterns in their tank boxes. Look the engines over occasionally. On the other hand,

Don't be stingy. If an engineman has managed to save a little valve oil from his allowance, let him keep it. A little valve oil on a hot box will frequently get an engine in and prevent an engine failure and its accompanying delays.

Don't let anybody but your storeman into your storeroom. Insist on his allowing no one inside the counter.

Don't let your storeman give out extra oil to enginemen without your written order. If you do you will find your oil consumption increasing rapidly. Every engineman at the terminal will have bad valve seats and hot journals on his engine and will want extra oil.

Don't say hard words about the master mechanic because he asks you for information in a hurry when you are busy. Remember he has been through the mill and that he is just as busy as you are. He probably wants the information to answer questions of the superintendent motive power and has to depend on you for it.

Don't have everybody in a scramble cleaning up the place when you get word of a coming inspection. Give your men to understand that the place is to be kept neat at all times, that tools must be put away when not in use, and material must be picked up. Keep your shop neat all the time and you need not fear any inspection.

Don't allow anyone but the men you assign to the work to move engines around the shop tracks. It will end in damage to an engine or in someone getting hurt.

Don't allow enginemen to come around at the last minute to prepare their engines for a trip. Insist impartially on their getting around in plenty of time to be ready to leave on time.

Don't show partiality toward any particular shopman or men. It will breed trouble. The same applies to enginemen.

Don't let your superior officers, or anyone else, come into your shop and order your men about. You are in charge of the shop and responsible for the work. Stand on your rights.

Don't allow *anybody* to smoke in the shop. It looks bad and makes for poor discipline.

Don't shift the crews of engines coming into your terminal, whose home terminal is elsewhere, unless you cannot avoid it, and then wire the other man what you have done, so he will know where he stands. You wouldn't like the other fellow mixing up your crews.

Don't memorize the enginemen's schedule and try to settle every question that arises by a hard and fast rule. So far from being "hard and fast" there is nothing so easy of different interpretations as the average enginemen's schedule. When in doubt as to the right course to follow get half a dozen enginemen together and discuss the point. If it doesn't lead to a decision then and there, it will at least thrash out the doubtful parts and start you on the road to a decision.

Don't take chances. Until the work is properly done on an engine don't supply the engine for a train. Almost anything is better than an engine failure.

Don't cut down your staff too quickly. The lull in business may only be temporary. Wait for instructions from a higher office unless you are very decidedly overmanned.

Don't increase your staff unless you are sure an increase in business is likely to last and your appropriation is increased. An engine house staff should have considerable elasticity.

Don't put up with engines leaving the shop late and trying to excuse it. There is generally a reason for a continuation of shop delays—very often the slackness of some particular man.

Don't get in a rut. If you cannot get away to attend the conventions or to visit other shops, at least read what the other fellow is doing. Possibly he is handling a larger shop than yours and under greater difficulties. You can learn something from him.

Don't forget that the shop and the engines belong to the company and that you are there to do everything possible to move the company's business promptly. While you are arguing about "your" men and "your" engines, don't forget that the company expects service from "their" engines.

SHOP SAFETY APPLIANCES AND SAFETY EDUCATION.*

BY GEORGE BRADSHAW,

Assistant to the Claims Attorney, New York Central & Hudson River.

Safety work has been taken up within recent months by a few large railway systems, not in an incidental way, but systematically, in charge of a regular bureau or department, or some official. It will not be long before every road of consequence will maintain a well-organized and equipped bureau or department solely for the prevention of accidents. Every preventable railway accident is due to one of three, or to a combination of three, general causes.

First.—Defective or improper condition of way, structures, equipment, tools or appliances.

Second.—Improper methods of work, or operation.

Third.—Failure of one or more men to use proper care and diligence.

In other words, every preventable accident is due to some insufficiency or failure of material, method or man. Every plan for the prevention of accidents, however enthusiastically proposed, should recognize two facts: *First,* that many accidents can never be prevented. *Second,* that the devices or remedies proposed for those which can be prevented must be reasonable in expense and practical in application.

Fortunately, the remedies for accident prevention, so far at least as safety devices go, are numerous, easily applied and generally of little expense. Almost all machines, tools and appliances can be rendered reasonably safe for proper operation by the installation of safety guards and appliances, which, for the most part, can be constructed in the ordinary shop from scrap or other cheap material. There is hardly any limit to the extent of the application of these devices. Of course, in the purchase of new machinery it should be stipulated and insisted that all parts be guarded by the manufacturer to the fullest extent necessary. The proper time and the best time to apply safeguards to any machine is when it is made. But until recently manufacturers gave almost no attention to safeguards and they are not now giving the matter the attention which should be required of them by the purchasers of their machines. As a result there are thousands of machines in use, and more (though not as many as formerly) are being installed, without necessary safeguards. These machines should be protected by "home made" guards, some of which are here illustrated.

A screen of fine wire mesh may be used to prevent injury by flying chips, as shown in Fig. 1. The use of this screen may be varied and extended by attaching it to a self-supporting frame which may be moved to any place in the shop where chipping is being done.

A bulldozer effectively guarded by iron pipe railing and boiler plate guards is shown in Fig. 2. Machines of this nature present more than ordinary hazard, and the railing alone is not sufficient. All movable parts should, if possible, be completely enclosed.

Fig. 1—Note the Fine Mesh Wire Screen to Prevent Injury from Flying Chips.

A turntable provided with iron pipe railing—a secure wooden railing would answer the purpose—is shown in Fig. 3. Protection of this nature is especially advisable where snow and ice accumulate. The only criticism of this particular construction is that there should be no braces on the inside of the railing because of the liability of stumbling over them. It is difficult to provide sufficient light for a turntable owing to smoke or steam, or the shadow of the engine. Note the high and favorable location of the arc light for this table.

A timber planer protected by box guards made of boiler plate is shown in Fig. 4. These guards would be more effective if

The article and the illustrations are taken from a book on "The Prevention of Railroad Accidents—A Heart-to-Heart Talk with Employees," which is now in preparation by the author, and which we are allowed to use through the courtesy of the publisher, The Norman W. Henley Publishing Company, New York.

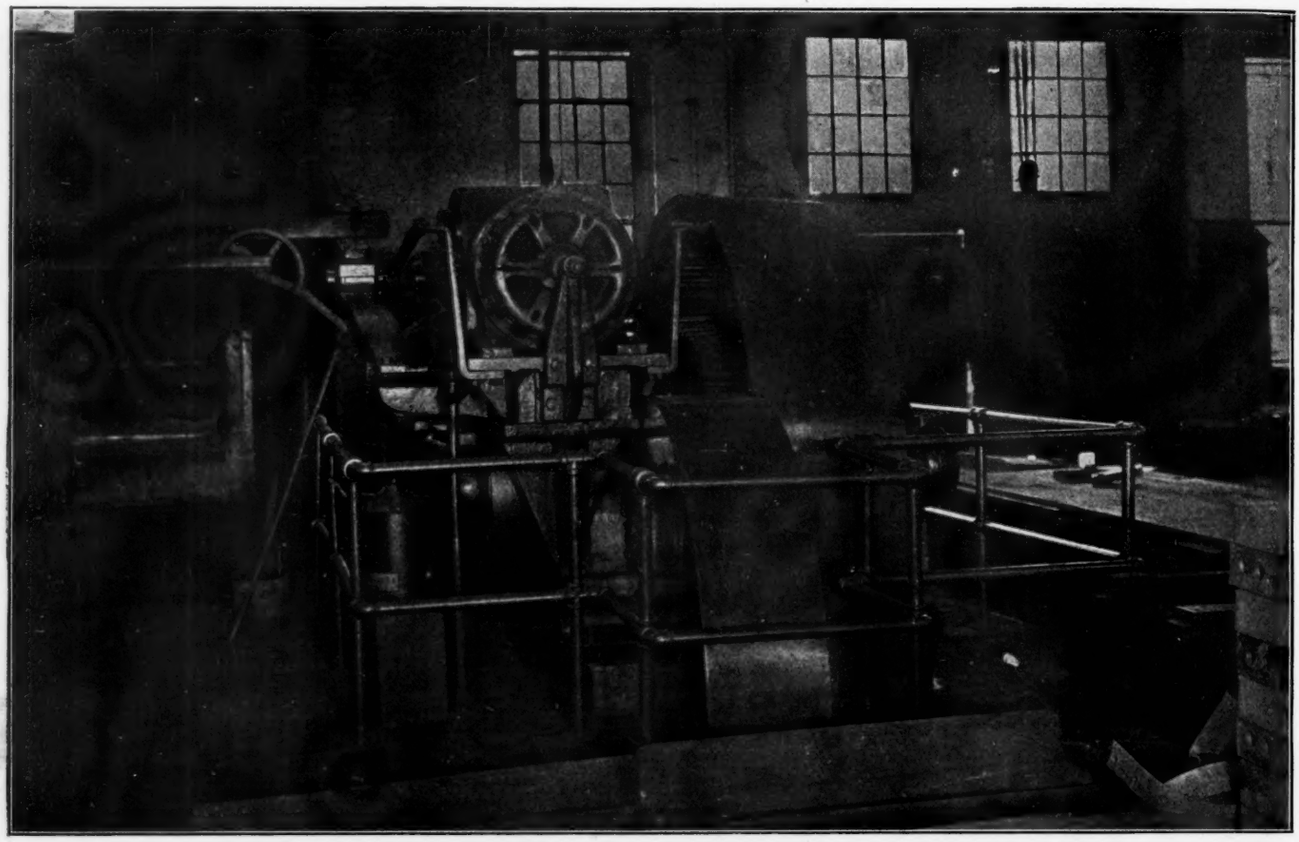


Fig. 2—Bulldozer Guarded by Iron Pipe Railing and Boiler Plate Guards.

Fig. 3—Turntable with Iron Pipe Railing. Note the Location of the Arc Light.

they extended completely over the wheels projecting beneath them, leaving no unnecessary exposure of movable parts. An example of complete and effective safeguarding of a driving wheel lathe is shown in Fig. 5. A strong box encloses all exposed gears and wheels.

The following are cheap, but effective, safety devices: A shield of ordinary flat glass about 4 in. x 5 in. in size attached to the front of the guard on dry grinding wheels, about 6 in. above the rest, prevents dust and sparks from flying into the operator's eyes, which is a frequent source of annoyance and injury. A "toe guard" around the edge of overhead platforms, stairways and walkways prevents tools or material from falling or being pushed off and striking some one working or passing beneath. It can be made by attaching a thin strip of board or metal around the edge of the structure so that it extends about 3 in. above the walk. Wood platforms (with the heads of all nails or screws sunk into the surface) placed on the floor in front of switch or panel boards, and of such size that one must stand upon them to reach the lever controlling the current, ordinarily afford safe protection from electric shock.

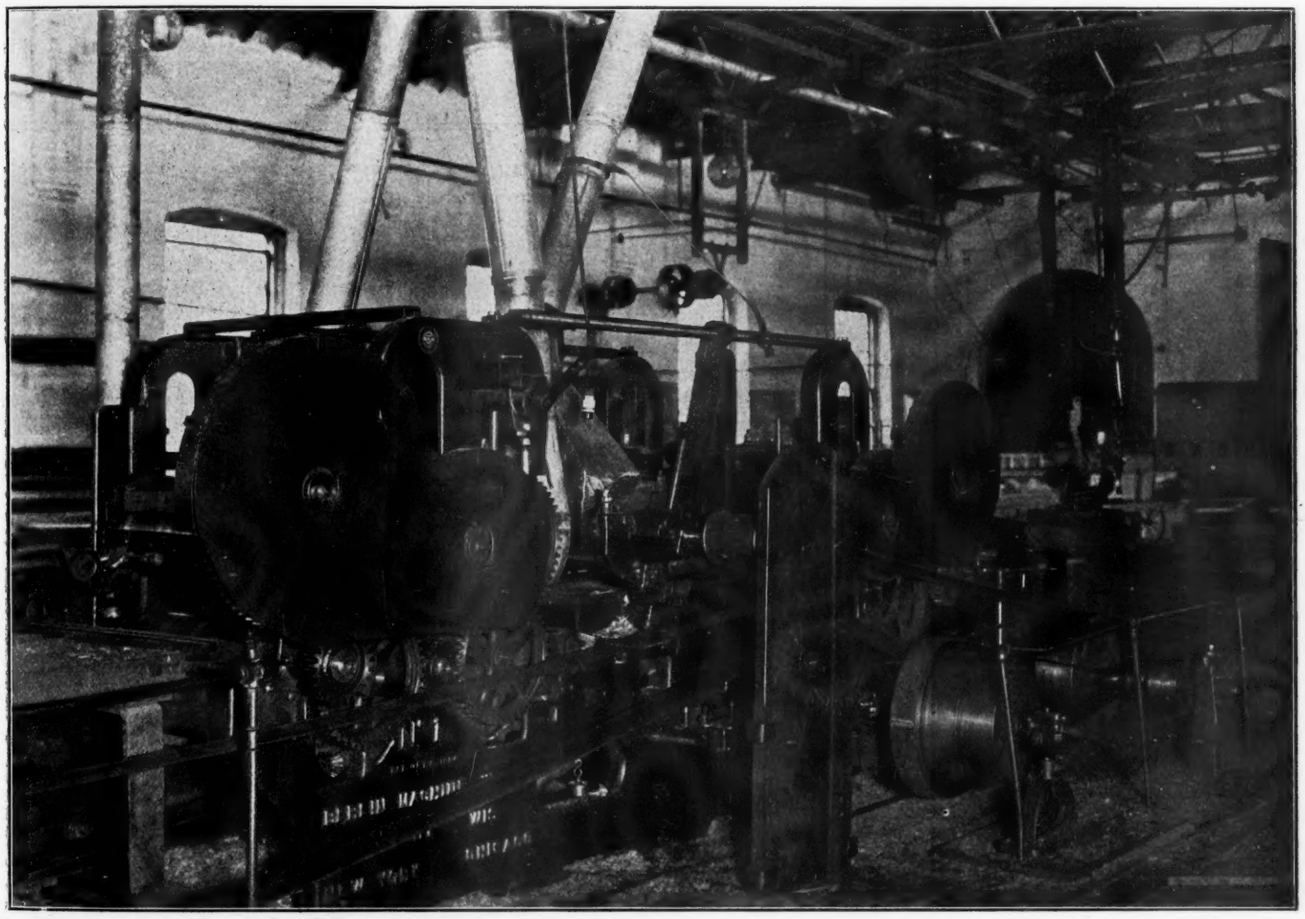


Fig. 4—Timber Planer Protected by Boiler Plate Guards and Railing.

CONSTRUCTION AND APPLICATION OF SAFETY GUARDS.

It must not be supposed from what has been said that the construction and application of safety guards is a matter of such simplicity as to require little thought and skill. Quite the contrary. In the first place, intelligent workmen—even foremen in charge—generally need to have their attention called to the presence of danger and the necessity for guards, on the machines with which they work, by some man who makes a special study of safety. They are often entirely unconscious of dangers which confront them every minute of the day until some one points them out. The following illustrations show actual conditions which those exposed had not thought of as at all hazardous until safeguards were applied.

A heavy, sagging and fast moving leather belt over a work bench, just high enough to clear the heads of the men at the bench is shown in Fig. 6. These men are liable to be caught by the sag of the belt, or struck by it, if it should break. Protection was afforded by placing immediately beneath the belt a wide plank, supported by brackets from the side wall.

A large set screw on a revolving spindle, in such a position that the operator had to reach around the spindle, thus bringing his sleeve in contact with the screw, in order to reach the hand clutch, is shown in Fig. 7. Several men operated this machine each day to not one of whom had it occurred that the head of the screw was likely to catch the clothing and cause a broken arm or other serious injury. A set screw which caught the clothing of the operator breaking his arm is shown in Fig. 8. The foreman in charge of the shop containing this machine and the men working under him were all of superior intelligence, but until this injury was received, it had not occurred to any of them that this and similar set screws should be guarded. One of the greatest dangers is presented by these revolving set screws, bolt heads or nuts. They can easily be rendered safe, as shown by the illustration, Figs. 9 and 10.

A box guard provided for the gears at the end of a lathe is shown in Fig. 11. It is necessary to change these gears, and in this case the guard was constructed to rest on the floor and extend around the gears which could be reached by simply setting the guard aside. The only criticism of this construction is that the operator is liable not to replace the guard. Where possible, it is better to attach the guard to the machine by hinges, so that it will swing shut of its own accord.

Guards for gear wheels should extend entirely over the ex-

posed part of the gears, and both ends of the guard should be securely attached to machine. The best style of guard is the box guard, which completely encloses the wheels, and this style should always be used where feasible, If the wheels are solid and the sides smooth (no spokes, bolts or holes), there is no great necessity for complete enclosure and the rim guard is effective. Rim guards should extend over the teeth. Fig. 12 shows an improper form of rim guard (not enclosing the gear teeth) and improper attachment of the guard, one end being unsecured, which not only affords incomplete protection, but

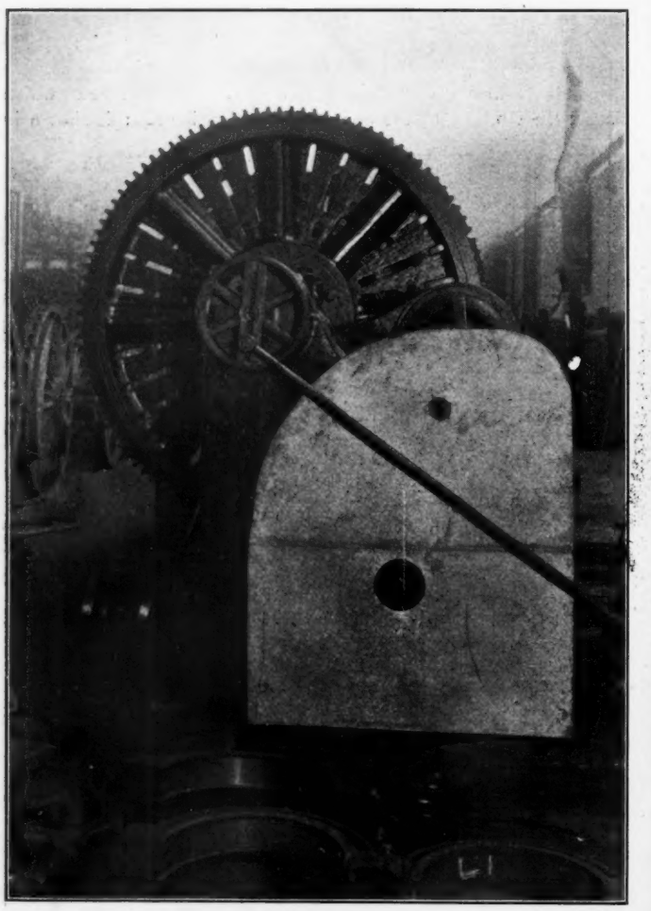


Fig. 5—Driving Wheel Lathe Gears Effectively Protected by a Sheet Steel Box.

presents an additional danger, owing to the liability of one's clothing being caught on the loose end of the guard. Fig. 13 illustrates the proper form of rim guard properly secured to machine.

The safeguarding of circular saws is a most difficult problem. There are a great many different types of guards for this purpose. The one shown in Fig. 14 is believed to be the most effective, because it is self adjustable, is not complicated and can easily and cheaply be constructed by any good mechanic. The objection to most other forms of circular saw guards is that they depend partly or entirely upon the workman for adjustment, with the too frequent result that he (especially if a piece worker in a hurry) pushes the guard up entirely out of the way and operates the saw without any protection. The part *A* is a strong piece of metal of the same thickness as the saw, secured in position beneath the table and of sufficient length to permit an up-and-down adjustment to conform to different size saws. The part *B*, attached by the bolt at *C*, allows the end of the guard to rest on the table and to move freely upward to conform to different thickness of material used.

Pulleys, flywheels and other dangerous machinery near the floors should be protected not only by railing, but by complete enclosure with solid material or wire of fine mesh. Don't 'think that guards are unnecessary because one "has no business" to get near the particular part of the machine to be guarded. We are compelled to protect the careless as well as the careful man. The device, which is "fool proof," is the most effective.

When safety devices are provided the men should be compelled to use them. The man who deliberately refuses or persistently neglects to use a proper safeguard provided for his own protection shows a reckless disregard for the safety of himself and his fellow-workmen, which, if it does not in his particular case result directly in injury to some one, furnishes to all the men in the shop an impressive and baneful example of indifference, even contempt, for safety regulations.

WARNING SIGNS AND SYMBOLS FOR SHOP DANGERS.

In some shops guards are painted red. This should not be done to indicate danger, because if the guards have been properly designed and applied, there should be no danger. If this practice has any merit at all, which is questionable, it merely serves to render the guards conspicuous, thus perhaps enabling the foreman, in passing through the shop, easily to observe any

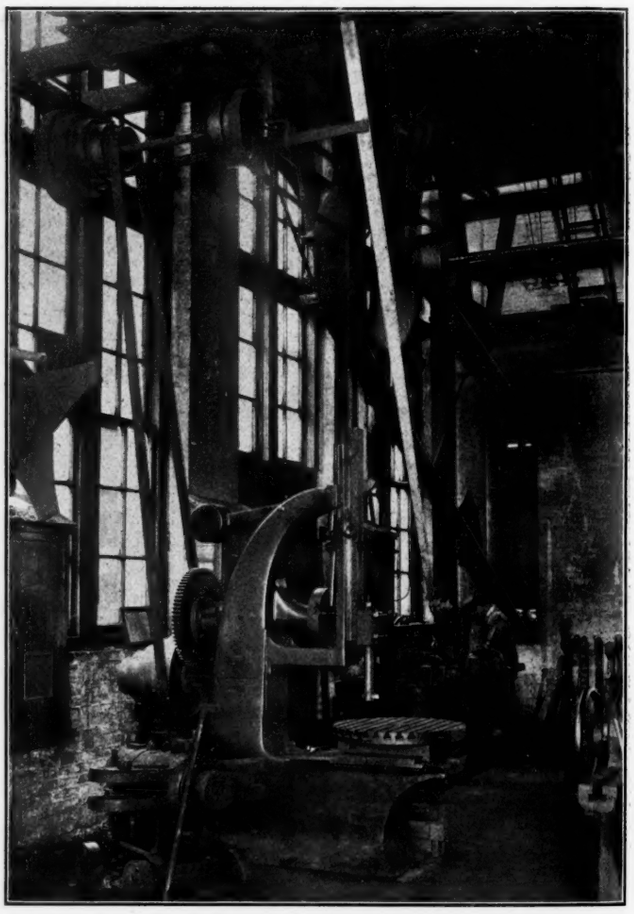


Fig. 6—Heavy High Speed Belt Which Should Be Safeguarded.

guard out of its proper position. But we hesitate to believe that there is in any shop such an adverse sentiment toward safety guards as to make precautions of this nature necessary. It is not advisable to apply a special color to the guards, but to use such indication, or some sign or symbol, only upon those parts of machines or at those places in the shop which, by reason of construction or environment, cannot be made entirely safe by guards.

A printed sign, as a means of calling attention to danger, is very unsatisfactory. It requires too much space, takes time

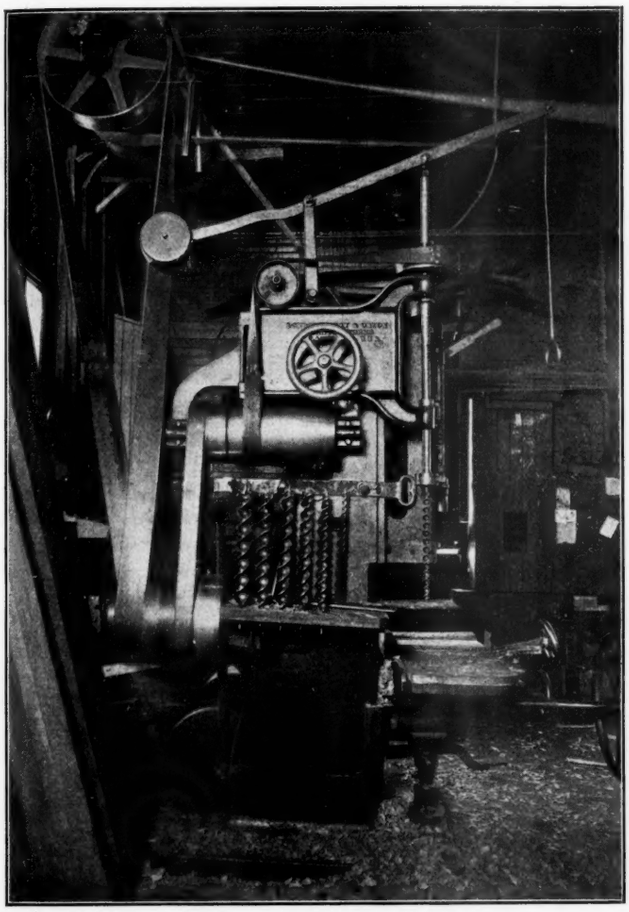


Fig. 7—Note Projecting Head of a Set Screw on the Spindle.

to read (which some workmen cannot do), and to reach all employees in the average large shop must be in many languages. What is needed is some simple distinctive and suggestive symbol, adaptable for use at all places and under all conditions, which, at a glance, will convey to all men a sense of danger of personal injury. Unfortunately, there seems to be no such symbol which has not already been so appropriated for other purposes as to have its meaning almost entirely restricted to its present application. The skull and cross bones, besides being difficult to execute, is too grewsome. The red cross is not available.

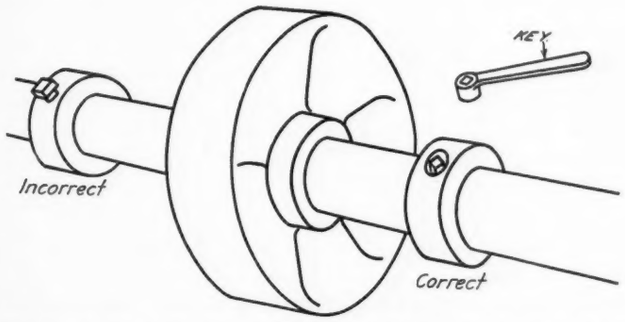


Fig. 9—A Good Method of Safeguarding Set Screw Heads on Revolving Parts.

The red flag is objectionable. Whatever symbol is selected—if ever any should be—will, of course, by use acquire the proper significance and become as peculiarly suited for the purpose as other symbols of long application. It is not, therefore, of vital importance what is adopted, provided it conveys an impression of danger and can be designed and produced with little expenditure of time or skill. Care should be taken in the use of warning signs or symbols to apply them only where there is a real danger, which cannot be overcome by safety guards. Their promiscuous and general application nullifies their effect.

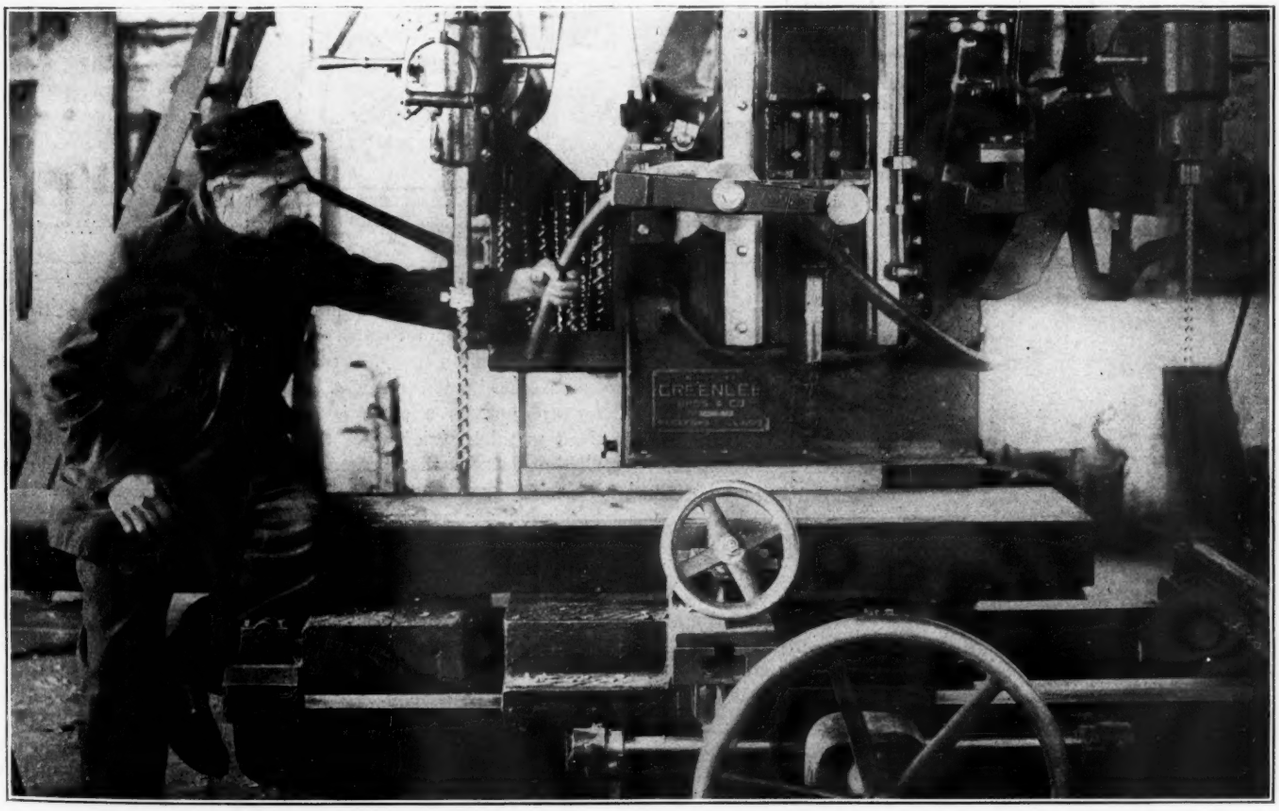


Fig. 8—Projecting Set Screw Which Caused a Serious Accident.

USES AND LIMITATIONS OF SAFETY DEVICES.

In any systematic plan for accident prevention it should be kept in mind that while safety devices are necessary and important they afford the means of preventing only a small percentage of accidents. Important as these devices are, we believe that in the public mind too much has been expected from their use. A study of the theory—aside from the practice of accident prevention—leads to this conclusion. If all men, at all times, were as careful and prudent as they could be, and, in theory, should be, there would be little need for safety devices; the necessity for such devices is in inverse ratio to the careful and prudent habits of those by whom the devices are to be used. Indeed, there is in theory this objection to safety devices, that they tend to eliminate the necessity for personal thought and alertness. In other words, if it were possible to so cultivate the human element in our shops, yards and on our tracks, without reduction of output or other detriment, that accidents would, because of such acquired prudence of the employee, be thereby generally prevented, this method would be preferable to the use of safety devices. But as we cannot improve the human element to this ideal extent, we use safety devices to accomplish the purpose.

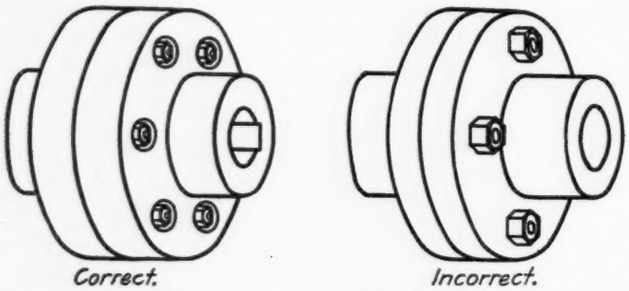


Fig. 10—Projecting Nuts on Revolving Parts Should be Safeguarded.

That too much consideration has been given to mechanical means of accident prevention and not enough to the human element is, we believe, clearly shown by experience. For many years railways have been introducing and extending safety devices and appliances on their tracks, trains and in their shops. We have had these appliances for years, and more of them each year. Yet for the last ten years (with the exception of one or two years) the number of employees of all classes, and the number of trainmen injured in proportion to the number employed has constantly increased. In other words, the personal injury record among employees has been going from bad to worse.

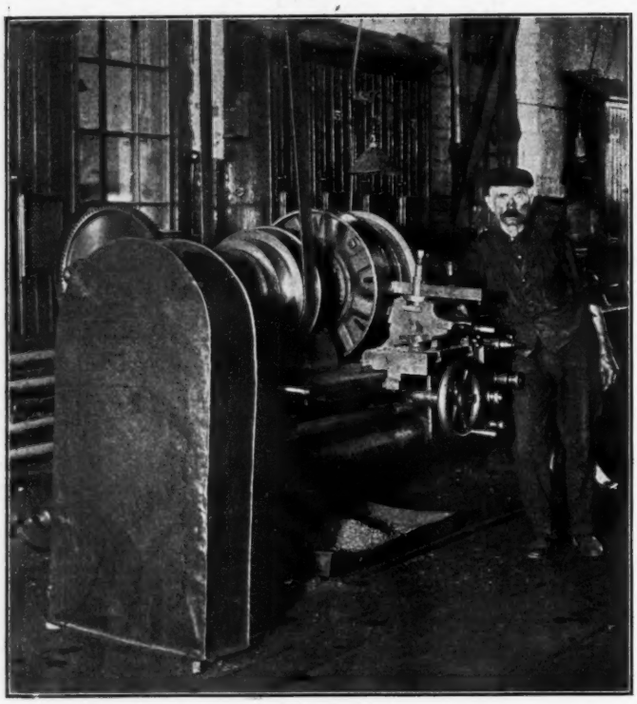


Fig. 11—Removable Safeguard for Lathe Feed Gears.

In Germany, where there are various museums of safety supported by government, and designed to foster the invention and introduction of safety appliances, and where, as a result of such stimulant and encouragement, these appliances are more ingeniously contrived and more generally used than in this country, it is still found, from reliable statistics, that as high as 48 per cent. of the accidents are preventable. The point is this: *No safety appliance is safe in the hands of an unsafe man.*

SAFETY EDUCATION.

It is a fact, clearly shown by statistics, that a majority of the preventable accidents are due to the third cause mentioned at the beginning of this article. Yet our efforts to prevent accidents have been confined almost wholly to the first and second causes. We have given, *not too much attention to material and method, but too little attention to man.* There is from all roads, especially from in and around shops, a constant stream of accidents due, not to any defect or insufficiency in material or method (unless to a lack of proper safety supervision), but to man—the human element. Railway men are not vicious. They are not, as a class, ignorant. But they have not been trained to think seriously of the sad results which may and do follow neglect of that personal duty, imposed by an authority prior and higher than the book of rules, to avoid injuries.

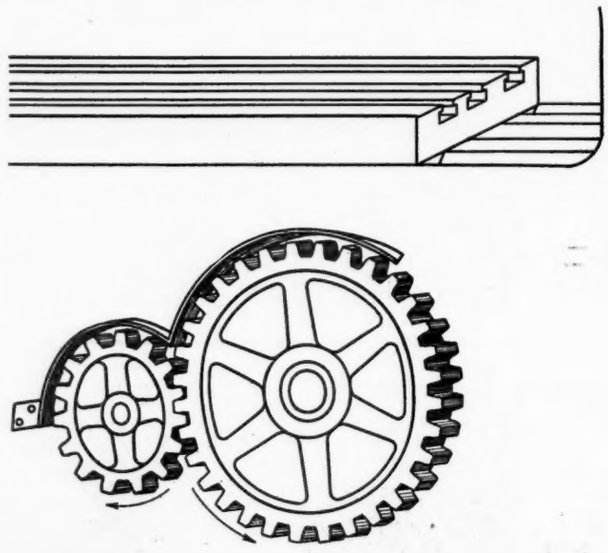


Fig. 12—Improper Form of Rim Guard for Gear Wheels.

Following are a few of the many almost daily examples of the effect of this indifference. Car repairers, trackmen and shopmen, in placing material or throwing aside scrap or rubbish, give little thought to its being kept clear of the space used by other employees in the performance of their duties. There are thousands of these unnecessary obstructions. Boards with nails projecting upward are placed and allowed to remain in and near traveled areas, and hundreds of employees are injured from this cause every year. One of the most absolute rules of all companies is that requiring car repairers, when under or about cars, to protect themselves by proper signals. This rule is so plainly necessary and of such vital importance that one would think self interest alone would be sufficient to insure compli-

ance. Yet experience shows that with a little relaxation of vigilance on the part of those in charge, this rule is promptly and persistently violated by the very men whose lives depend upon its observance. Even with the greatest vigilance on the part of foremen, it is not at all unusual for men to be injured or killed in the violation of this rule.

It is unnecessary to extend this list. A study of railway personal injury records shows that every day scores of persons are injured or killed because some employee did, or failed to do, something which could not be foreseen and be made the subject of

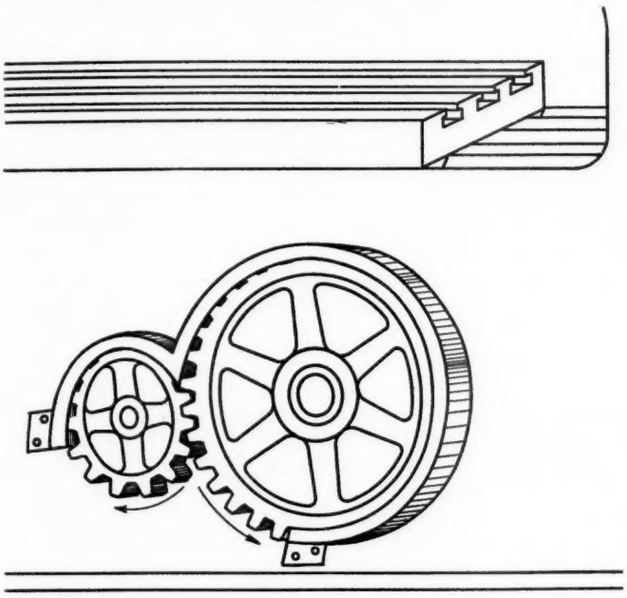


Fig. 13—Proper Form of Rim Guard for Gear Wheels.

a rule or of instruction and which, even if it could be anticipated, is so plain and simple, as to the duty imposed, that to make it the subject of detailed and specific instructions would almost seem an affront to one's intelligence. Indeed, safety efficiency cannot be procured, except to a limited extent, by specific rules and regulations. We have had plenty of rules and regulations for the performance of general duties, but the personal injury record of employees has been growing constantly worse.

It is true that we need more, not fewer, safety appliances, but we also need, and need badly, a vigorous campaign of edu-

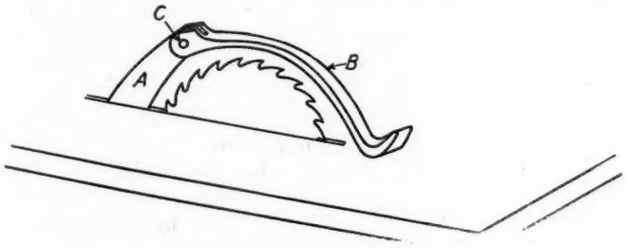


Fig. 14—A Good Guard for Circular Saws.

cation among employees for accident prevention. Safety appliances, plus this education, plus official supervision, with safety as the sole end and not an incidental consideration, will, in a few years, bring about a much desired change in our accident reports. The lesson to be impressed upon us by the large number of preventable accidents, due to some extent to a lack of safety appliances, but to a greater extent to the indifference or positive negligence of employees, is this: *We should, by systematic and persistent safety inspection, education and supervision, awaken the interest, quicken the understanding and strengthen the judgment of employees, so that their pride, intelligence and personal interest will bring about that effective co-operation with the management which will result in real safety efficiency.*

TRAINING OF APPRENTICES AND WORKMEN.*

BY L. L. COLLINS,

Bonus Inspector, Atchison, Topeka & Santa Fe, Albuquerque, New Mex.

The apprentice who enters a railway shop where a regular organized apprentice instruction system is in force has many advantages which were not offered years ago. The modern apprentice schools, which include every facility for learning, are a great help, especially where classrooms with drawing tables, drawing boards and instruments, models and lesson sheets are provided, and where an experienced draftsman acts as the instructor and teaches mechanical drawing and mathematics. Each apprentice usually attends school twice a week for a two-hour session. The morning sessions have proved to be the most productive, as the young men are brighter then, and can grasp things more readily. The method of teaching is different than that of the public schools. Each boy is advanced as fast as he is able, and a dull boy does not keep back the bright one. Nevertheless, the dull boy is given every assistance, special attention being given to help him.

The apprentice school teacher is supplemented by a shop instructor who teaches the boys in the shop. It is essential that a man in this position be of good moral character and a good mechanic. Good character is necessary, for as he is over a number of young men he is considered, more or less, as a standard or example, and usually has a great influence over the boys. At the age a young man is learning his trade every care should be exercised to develop his moral character as well as all his skill in the trade, for it will mean much to him later and will help to make an upright citizen of him. The apprentice should be governed by a set of rules, which may be few in number, but should be enforced to the letter.

The instructor's duties are sometimes trying, and considerable patience is often required when handling the young men, but kind treatment, with an occasional heart to heart talk, will generally have the desired effect. Under good treatment the young man will soon take an interest in his work and take hold of it with a vim. The idea of giving prizes to apprentices for excellence in efficiency has some advantages, as well as disadvantages. In considering a case where the railway company agrees to pay each apprentice who finishes his trade in a satisfactory manner and at a certain efficiency as a workman, a stipulated sum, would it not create a temptation to gain the efficiency no matter how it was done? On the other hand, one young man may be bright and another dull; the bright boy can easily hold his efficiency throughout his time, while the dull young man will have to work much harder to attain this efficiency, and the prize will be an incentive for him to do so. However, prize winners do not always make the best workmen.

Shops where only a few apprentices are employed and no apprentice school is provided should have a traveling instructor. He could handle three or four shops each week, and should be not only a school instructor, but a shop instructor as well. There are handy men and laborers who in their younger days did not have the opportunities which the young men now have, but who are desirous of advancement and learning. For these a night school might be established where for a nominal charge they could receive a course of training similar to that given the apprentices, with the exception, of course, of a shop instructor. The shop foreman could see to their instruction in the trade, provided the workmen showed sufficient inclination and ability. Some of these men will surprise you in the way in which they develop into first-class mechanics.

*Entered in the competition on the Instruction of Workmen and Apprentices, which closed April 15, 1911.

PROTECTIVE VALUE OF PAINTS FOR STEEL STRUCTURES.*

BY J. H. PITARD,
Master Painter, Mobile & Ohio, Whistler, Ala.

In view of the increasing use of steel and iron for structural purposes, the great strain it is designed to endure, the large amount of capital involved, and the consequent longer service naturally to be expected of it, as compared to wooden structures, the selection of suitable protective coatings becomes a matter of the highest importance. The eroding effect of oxygen on inorganic substances is a well-known scientific fact, and upon certain substances, such as unprotected steel, its destructive effects are rapid and ruinous.

There is quite a difference of opinion even among practical painters who have given much study to the subject as to the most suitable and enduring paint for this purpose. The exclusion of moisture, of which oxygen is a constituent, is the main point at which are aimed the efforts of the engineer, the painter and the paint manufacturer, in order to combat the ravages of oxidation. In recent years the manufacture of paints has been specialized to such an extent that the multitude of iron paint specialties are almost bewildering, and notwithstanding the high claims made for them, their virtues must be demonstrated by actual service tests. The construction of some steel structures is such as to render certain parts inaccessible for repainting, and the initial painting is the final one; therefore the selection of the most enduring paints, regardless of cost, for such parts, if not for the entire structure, is plainly of the greatest necessity. A combination of paints is necessary to secure the best results in the painting of steel and iron, as in other lines of painting.

Red Lead.—The paints generally used for the protection of steel and iron are red lead, carbon and the iron oxides. Of these three, red lead is perhaps the general favorite, its use for this purpose having met with variable success; as to its fitness there is much that may be said, both for and against it. Its protective value in damp situations has led to its general use on steel structures; but it is doubtful as to whether the same results can be obtained in dry situations. Red lead, being a strong natural and progressive dryer, when mixed with linseed oil will cause the oil to dry thoroughly hard, which, together with the close texture of the red lead makes an almost impervious coating. This is the whole secret of its protective value in damp places, but its progressive drying tendency becomes an element of weakness when placed in dry situations, especially when exposed to the sun. Under these conditions, aided by the heat of the sun, it burns out its life more quickly than where it is protected from the elements, or where it is submerged in water, as on the hull of a vessel. Better results may be gained by using red lead only as a first coating, and possibly a second coating, and finishing with one or two coats of a good elastic carbon paint. This method is especially suited to steel bridges or other exposed structures. The hard drying tendency of red lead in dry and exposed situations may be largely overcome by the addition of a small per cent. of some of the numerous paint oils, such as cottonseed oil, for instance, whose iodine value is considerably below that of linseed oil. A. H. Church, professor of chemistry in the Royal Academy of London, in his work on the Chemistry of Paints and Painting, says: "Red lead may be approximately represented by the formula $Pb_3 O_4$. The paler and more orange tinted varieties contain an excess of protoxide of lead, often accompanied by a little carbonate. This pigment is peculiarly liable to discoloration in the presence of sulphuretted hydrogen; it acts energetically upon some paints, on the cadmium yellows, for example. It is quite inadmissible as a water-color and cannot be considered as safe in oil."

Red lead becomes a safer paint when its weak points are made known, for it may then be arranged in combination with other paints so that they will mutually strengthen each other and give better results. While it must be admitted that good results may be obtained by the intelligent use of red lead, it contains so much oxygen that it is liable to impart some of it to the iron it is supposed to protect and thus cause it to corrode. Especially is this true where the iron surfaces have not been thoroughly cleaned before painting. In such cases oxidation slowly continues until in some instances sheets of metal are perforated, while to outward appearances the paint is intact. It is, of course, obviously unfair to attribute the fault to the paint. The thorough removal of all rust preparatory to painting is of the greatest importance, not only in the case of red lead, but in the use of any paint intended for the protection of steel or iron. Red lead in some respects is not unlike japan drier, which in small quantities in combination with other paint compounds will cause the mixture to dry within a reasonable time; where japan alone is used as a protective coating it very soon becomes hard and brittle, and will flake or crumble off. Red lead being a progressive, and a strong natural dryer should have its tendency to excessively hard drying counteracted either by the admixture of non-drying inert substances, or by the use of some of the slower drying oils as suggested above. Rightly mixed and applied according to the varying conditions of service, red lead becomes an excellent metal protector.

Oxide of Iron.—Oxide of iron when mixed with linseed oil, although entirely different in nature from red lead, constitutes a metal coating of considerable merit. The quality of the oxide, however, is of course a determining factor. The essential requirements of an oxide for a metal coating are that it should be thoroughly dehydrated and free of sulphur or other injurious constituents, and finely ground. In some respects oxide of iron paints do not compare with red lead, as for instance in damp localities, for the reason that having no natural drying qualities, and being of a more porous nature, the pigment and oil do not reach that degree of cement hardness necessary to render it impervious to moisture; for this reason it would constitute an inefficient protector to the hull of a vessel, or to structures similarly exposed. In dry situations, where a sufficient number of coats are applied under proper conditions, the results will be equal to or better than red lead, and more economical. As oxide of iron has no natural drying qualities, artificial drying must be resorted to, and for this purpose a small proportion of red lead or litharge is superior to the liquid dryers. Oxide of iron paints also constitute an excellent top or finishing coat over a red lead under-coating where the color of the latter is objectionable. Experience has proved it to be superior to white lead for this purpose. To obtain the maximum durability from any of the group of iron oxides, they should be ground in linseed oil; if mixed with the oil in their dry state, the assimilation is imperfect and the durability is correspondingly less.

Carbon Black.—Carbon black when mixed with linseed oil was, until recently, much in general favor as a protective coating for iron and steel, but tests have demonstrated unmistakably that it has galvanic or electric properties which accelerate rust. This, however, is the case only when it is applied directly on the metal; as a top coating over red lead or other coatings, most excellent results may be obtained. Like the oxides, however, it is unsuited to damp localities. In dry places, or where exposed to sun and rain, it is superior to either red lead or the oxides. As in the case of other pigments, the quality of the carbon must be considered, as there are different kinds of carbon having varying degrees of merit. Carbon known as the old style lamp black when mixed with refined linseed oil constitutes the most durable paint for general painting upon either wood or iron, but in exceptionally damp localities, as on the hull of a vessel, it does not compare with red lead. Carbon is an inert pigment; it has no natural drying properties whatever; on the contrary, it carries a small per cent. of carbon oil, which greatly retards its drying, which, however, is more of a virtue than other-

*Awarded the second prize of $20 in the competition on Paint Shop Practice which closed November 15, 1911.

wise, since it counteracts the hard drying tendency so common to red lead, and thus adds to the elasticity of the coating. In general practice, when painting steel cars, steel bridges, etc., a first coating of red lead followed by two or three coats of carbon paints, will produce much better results than where red lead alone is used.

Linseed Oil.—To secure the best results in painting steel or iron structures with any or all of the above mentioned paints, the combinations should be arranged to suit the conditions. The basic part only of the paints considered above has been discussed. The other constituent, linseed oil, with which they are mixed, is of equal importance. There are several qualities of linseed oil, the quality being regulated perhaps more by the manner in which it is made than by adulteration, although there is more or less adulteration. Linseed oil has a strong affinity for oxygen, gaining about 13 per cent. of its weight by absorbing oxygen as it dries. This characteristic is somewhat detrimental to coatings on iron or steel, as more or less of the oxygen is imparted to the metal, resulting in oxidation. Raw linseed oil contains more or less soluble matter that is not to be found in the boiled oil, and for this reason the boiled oils make the best paint when mixed with carbon or the oxides; for mixture with red lead it should be boiled, but the litharge should be omitted, as the red lead is a natural dryer and needs no supplementing. Another feature of linseed oil, highly essential to durability, is its age, for its durability is in proportion to its age. Immature oil, although pure, will prove far less valuable than oil that has had one or more years aging.

Number of Coats.—A common error that is productive of most unsatisfactory results is an insufficient number of coats. The best results are obtained where the body of paint is of sufficient thickness to exclude moisture. This cannot be done with one coat of any kind of paint. The number of coats necessary in each case is governed by conditions and the thickness of the coatings, and by the kind of paints used. From three to five coats should be applied, according to conditions, with ample time between coats for drying.

The maximum protective value of any coating applied to steel or iron can only be obtained by having the metal free of moisture when the paint is applied. Painting raw iron in damp or frosty weather is generally productive of poor results, as the moisture becomes sealed up in the pores of the metal and oxidation soon results.

TIN AND COPPER SHOP KINKS.*

BY C. C. LEECH,
Foreman, Pennsylvania Railroad, Buffalo, N. Y.

BABBITTING BENCH.

A convenient bench for use in an engine house for babbitting and relining such parts as crossheads, shoes, driving box sides, bearings, etc., is shown in Fig. 1. It should be strong and arranged specially for this class of work. The bench shown is made of oak, strongly bolted together, and is covered at the top with an iron plate ⅜ in. thick. To protect the wood underneath, the iron plate is supported on iron strips 1 in. square and spaced on 7 or 8 in. centers, as shown on the drawing. The tool shelf underneath is used for the storage of the various formers and mandrils, and such other tools as are used in this work. A small gas furnace for heating soldering irons, and a larger one for melting purposes are located near the bench.

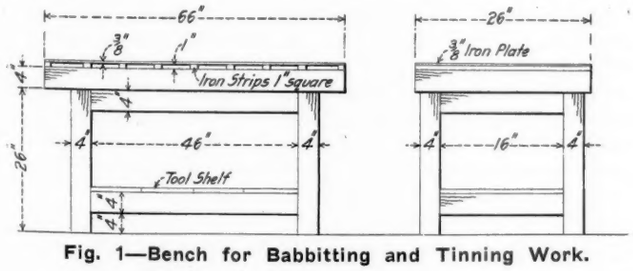


Fig. 1—Bench for Babbitting and Tinning Work.

BABBITT FURNACE.

The babbitt furnace, shown in Fig. 2, is placed near the bench, which is described above. It is of cast iron with substantial wrought iron legs. Openings are left in the upper part of the furnace to receive the square cast iron melting pots. The interior of the furnace is lined with fire brick, as shown. The air pipe enters the elbow in the gas pipe, thus allowing the air and gas to mix before it is discharged into the furnace. The supply of both the air and the gas is controlled by globe valves in their respective pipes. No burner is required other than the 1 in. pipe which enters the furnace underneath the center of each melting pot and within 2 in. of its bottom.

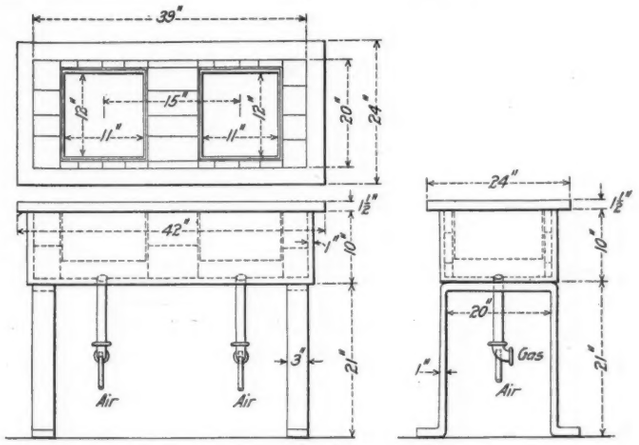


Fig. 2—Babbitt Furnace.

SOLDERING IRON FURNACE.

A furnace for heating soldering irons is shown in Figs. 3, 4 and 5. It is made of No. 14 iron, which is riveted to vertical ¾ in. x ¾ in. angle irons, which extend below the bottom of the furnace and serves as legs. The sides and top of the furnace have an inside lining of ¼ in. mesh screen, which is filled with fire clay.

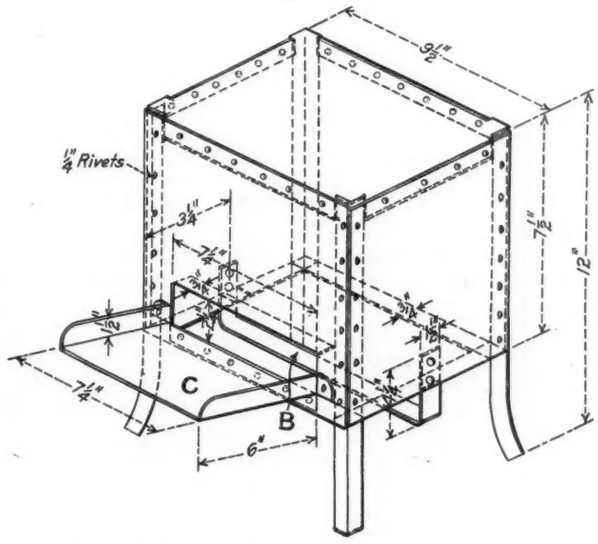


Fig. 3—Furnace for Heating Soldering Irons.

The bottom of the furnace is open. The burner, which is con-

*These kinks are part of the collection which was submitted by Mr. Leech in the shop kink competition that closed May 15, 1911, in which he was awarded the first prize of $50.

structed of ½ in. T's and nipples is shown in detail in Fig. 5. It is supported by the bracket *B*, and has attached to it an air mixer, that is made from a 2 in. pipe sleeve with the ends plugged as shown. The soldering irons are laid on the shelf *C*,

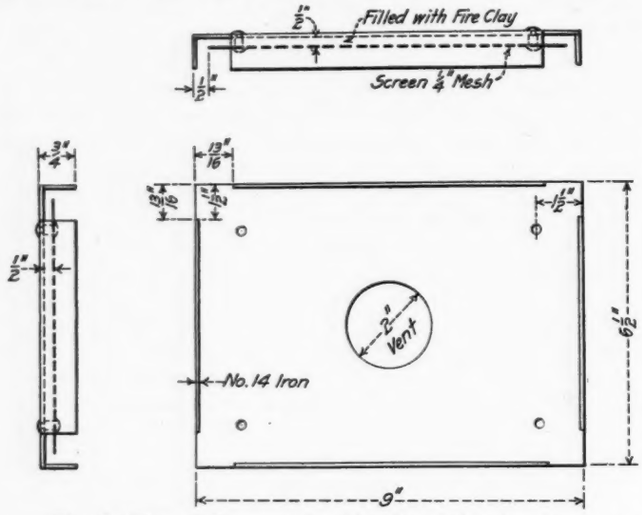


Fig. 4—Top of Furnace for Heating Soldering Irons.

which is attached to the front of the furnace, the copper ends of the irons extending over the flame. The furnace may be used either as a permanent fixture in connection with the babbitting

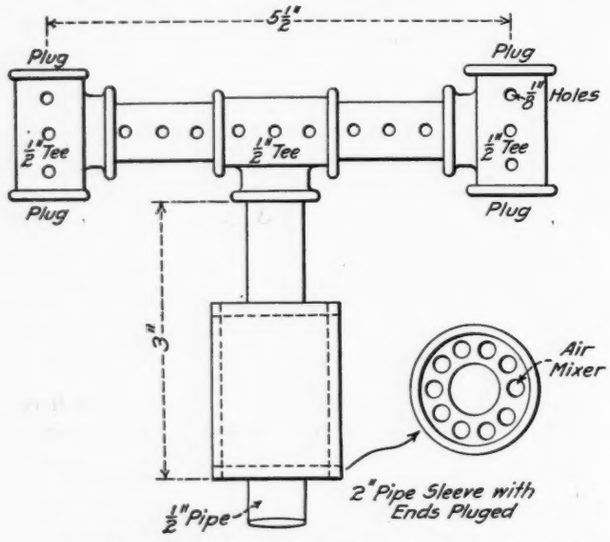


Fig. 5—Burner for Soldering Iron Heating Furnace.

bench, Fig. 1, or if advisable it may be used as a portable device, if the proper air and gas connections are provided at various places where it may have to be used in the shop.

BABBITTING ENGINE TRUCK BEARINGS.

The mandril for babbitting engine truck bearings, Fig. 6, is used in connection with the babbitting bench, Fig. 1. It is made

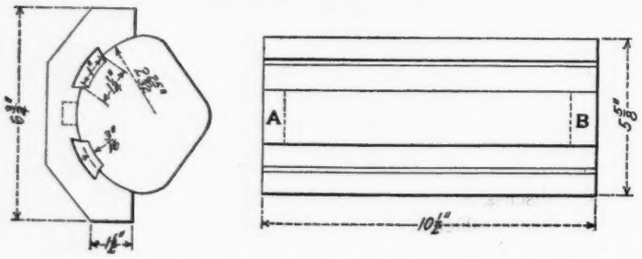


Fig. 6—Mandril for Babbitting Engine Truck Bearings.

of cast iron, and the side which comes in contact with the bearing is turned to the proper diameter, after which the slots are planed. The slots are tapered ⅛ in., being wider at the top end into which the metal is poured, thus facilitating the removal of the mandril. The two strips of babbitt can be connected across the ends by removing the metal at *A* and *B* on the mold.

MOLD FOR METALLIC PACKING.

The mold for metallic packing shown in Fig. 7 is made in two parts, which are hinged together. A tapered mandril of the proper size is placed between the two parts of the mold before they are closed and clamped together. After the metal has been

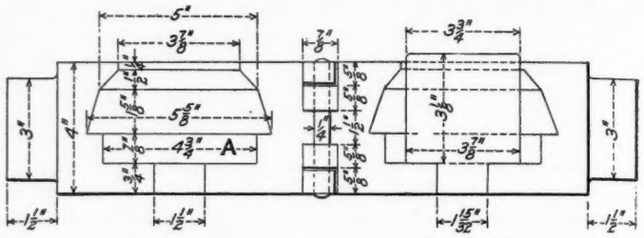


Fig. 7—Mold for Casting Metallic Packing.

poured the mold is opened and the casting removed. The mandril is driven out, after which the packing is ready to be bored, turned to size and divided into three rings or parts. The mold is, of course, made so that the casting is formed approximately to the proper shape and requires very little finishing. The part *A* on the casting is removed, its only function being to assist in holding the packing in the chuck while it is being machined.

EFFICIENT SHOP MANAGEMENT.

A most interesting and comprehensive address on The Economic Administration of Industrial Establishments was given before a joint meeting of The Altoona Railroad Club and The Engineering Club of Altoona, Pa., by John Calder, manager of the Remington Typewriter Works. The following extracts are taken from the introductory portion of the address which contained an outline of the broad principles that are followed by the Remington Company and which are applicable to any type of shop:

THE NEED FOR GREATER EFFICIENCY.

The function of organization in shop administration is not alone the important one of operating plants economically, but also to anticipate trade fluctuations, to measure up with care the prospective value and desirability of extensions, to check mere bigness of project and endeavor to make reasonable provision for a contracting expense of organization during a period of depression.

THE IMPORTANCE OF ORGANIZATION.

The primary object of organization is to bring brainy men together for work and action. A wise organization seeks and encourages men of ambition. It believes that the ambitious man is not necessarily dangerous. It knows that success demands an aggregation of strong individualities, free to contribute their quota of wisdom but loyally subordinating their individual preferences to the general policy once declared.

In order that its work may be well done and its action strong and forcible the organization must move forward as a harmonious unit. No amount of clever scheming alone will secure this. Herein lies the task and the genius of the organizer of men as distinguished from the mere systematizer of things. His work is much easier to talk about than to carry out, but it needs brief mention here.

The organizer's success will depend not merely, or even chiefly, on extended technical experience and close knowledge of the business, but upon his ability to select his assistants, to transfer

his own work to them and to inspire those assistants with his own ideas, his own energy and his own ability. Emerson says "Every great business is but the lengthened shadow of one man," and he is right. The modern administrator of industrial establishments is a manager of men rather than of things and the human factor touches his business on all sides. An organization, therefore, must have a strong, resourceful leader and a carefully selected, well trained, loyal and enthusiastic staff. This will only come through intimate contact with a man, not a mere machine or inanimate system. Having chosen men, frequently young men, for their record and potentialities, particularly for signs of executive ability, a not too plentiful quality, they should be expected to win solely on their merits and to make the most of the business by making the most of themselves. Unless the leader sees and plans for an opportunity for a useful career, not only for himself, but for his staff, he cannot reach the highest success.

The cold-bloodedness of some of the modern schemes for exploiting the higher human energies is not only repelling—it is a fatal defect.

THE SYSTEMATIZER.

Organization, though the greatest factor in business, implies co-ordination, or system, and not much can be accomplished without the aid of the latter. Business methods and apparatus, particularly those of mechanical and transportation concerns, are being closely scrutinized and many proposals made for securing greater internal economy. At such a time it is well to bear constantly in mind that any system, however attractive and justifiable in some of its features is, like the plant itself, worth no more than it can earn. No manufacturer is in business as a subject for experimentation which may not point the way, but merely warns others from following. All money and worry expended on system beyond the earning point is wasted.

An admitted experiment of measured duration and conclusive nature is one thing, but a shop revolution covering years of transition experiences is irretrievable and usually unsupportable. Dead uniformity and absence of scope in a system for individual initiative and incentive are not necessarily factors in securing what are the sole justifications for special outlays on system, viz., absolute certainty of increased economy, accuracy and despatch. In concerns in which system is an expensive hobby and not an economical tool, all kinds of extravagancies will creep in and will be justified by some philosophy which ignores common sense.

One of the claims brought before proprietors by some of the external practitioners of system is that it will not only render the efficiency of their business self-perpetuating—a most desirable end, if attainable—but that it will also enable them to become, to a large extent, independent of their managers and higher executives. This is a somewhat mischievous doctrine. No army of clerks, mechanically following planning instructions however perfect, can take the place of the full use and recognition of able engineering administrators and shop assistants under any conceivable works system. The human element in system, as well as in organization, is half of the problem, and there is a tendency to too great rigidity in most of the shop systems offered for general application. It is not a recommendation for any business system, imported from the outside, but rather the reverse, that it should insist upon absolute conformity to type in details without regard to the problem in hand and the great amount of experience already acquired from it. Some of the most practical modifiers of shop management are fully alive to this, but there is a tendency amongst the less wise to vigorously wield the new broom.

The best type of shop system is evolved, not from the outside, but in the shop itself through careful analysis of its special conditions and requirements by the responsible administrator thoroughly in sympathy with and experienced in advanced practice. *A busy and prosperous administration can sometimes be helped by system advice from the outside. It should never be controlled by it.* The most natural tendency of the outside adviser without responsibility for current product and profit is to stereotype the detail of his previous limited practice and dry up the springs of initiative and suggestion within the plant. The best system for any particular shop is that which will co-ordinate all the efforts of a good organization and which will draw out and suitably reward the best effort of every one concerned—not forgetting the employer. The most suitable management for so doing will never be exactly alike in any two cases, though the principles followed may be identical.

SCIENTIFIC MANAGEMENT.

It was to an already progressing and intensively developing shop practice that there was presented ten years ago scientific management. It appeared at first with a more modest title and made its appeal through the ordinary professional channels to the engineer. It was a worthy appeal based upon a quite unusual amount of self-denying investigation, but it did not receive the immediate consideration it deserved. This was partly because the straw man which it set up and repeatedly and vigorously knocked down was merely a lay figure and not really representative, as alleged, of the best existing shop practice. In the case of the more open minded and thoughtful engineers, ready to learn from any source, the science of the movement was accepted with considerable reservation and from the humanitarian point of view the illustrations used by the gifted author of the system laid it open to not unjustifiable attack and to the complaint that though a deeply interesting experiment had been made, it did not justify the far reaching generalizations based upon it.

In the ten years which have elapsed professional efficiency engineers with no such experience as the able author of scientific management have multiplied somewhat more rapidly than the demand for this service would warrant and quite recently scientific management itself has caught the fancy of the press and of the man in the street and has been let loose through a popular propaganda upon an indiscriminating public. It will come back to its moorings after a while. Actually the particular system described and advocated by Fred W. Taylor has made relatively little progress, and while economic administration of industrial establishments has been not a little quickened by its advent and discussion, the most of the general advance has been the result of causes operating before that event, and much of it has not been along the specific lines of such proposals in scientific management as are original with its author. The fact of the matter is that Mr. Taylor's scientific management is a very big and difficult task requiring professional ability of the highest order. Stripped of the data, apparatus and phraseology which have led careless readers to think of it as a new way of running machinery, of paying men, of avoiding labor trouble, of insuring dividends, etc., it is neither more nor less in its essence than a proposal to revolutionize our industrial life. Viewed in that light it is a most interesting and suggestive speculation which well repays close study by engineers. It presents itself to the shops in complete technical detail, a most expensive detail, and many businesses cannot contemplate the years of outlay involved before the returns promised should accrue. The author of the system is entirely frank on this aspect of the case and system practitioners whose promises have a "get rich quick" flavor are certainly not installing the genuine scientific management.

The writer believes thoroughly in the principles enunciated by Mr. Taylor, but is of the opinion that they are offered for application in a detailed system too complicated, rigid and unyielding for immediate application to every day needs. Shop management is an art rather than a science. It has to deal with too many unknown quantities and variables either to aspire to scientific rank or to adopt a fixed creed. Few individual businesses can afford the interference and expense involved in carrying out effectively the extensive scientific programme of the proposal under discussion. By professional societies or national agencies many shop problems still unsolved might possibly be greatly assisted without the risk of interfering with business but the installation of the whole machinery of scientific management has

been very seldom attempted. Nevertheless, though committal of a shop to one rigid programme of outside origin in all its implications—and the control of the business it must be remembered is an invariable stipulation—is not, in the writer's opinion, desirable; there is plenty of scope for more systematic analysis and regulation of shop processes and expenditures. The business world, and engineers in particular, owe much at present and will owe more to the ability and devotion with which the author of scientific management has elaborated and advocated his particular combination of things old and new.

THE PROPER USE OF SYSTEM.

There are several rules in regard to office and shop routine which the writer would recommend all managements to observe, irrespective of the class of work done.

First, have a well considered system of doing things, definite and business-like in all departments, not an imitation of something else, but one designed for your own case.

Second, see that a broad view of the subject is taken and provision made for properly dovetailing the various department systems.

Third, make the connection clear to all employees by the use of a chart. Such a table is self-interpreting and saves much explanation.

Fourth, have as little system and as few forms as possible. Make them a means, not an end. There are many daily items of shop practice being perpetuated in expensive card systems today of which no use whatever is being made, or is ever likely to be made.

Fifth, do not treat the system as a fetich. It is a good servant but a bad master. So much of it as is justifiable is merely organized common sense. Prune and pare your system until it gives the utmost economy and despatch.

Sixth, do not fail to note closely what your system costs and if it is really paying its way. Very few experts can answer that question. With many it is purely a matter of faith.

Seventh, be always on the outlook for improvements and suggestions from any responsible quarter and discriminating in adopting them.

The writer has spoken of useless records with reference to data which need not be recorded at all in permanent form. Some other records are useless, because their form renders them so for the purpose of frequent and rapid reference. Still other records are useless because they are inaccurate and unreliable. The writer has heard it urged, in all seriousness, that detailed shop and cost data cannot be trusted, but this is simply a plea for slovenliness which the users would not tolerate in their own technical spheres. It is just as easy and cheap to collect—almost automatically in a good system—correct figures as it is to record inaccurate ones, and the man who knows exactly what he is accomplishing will always come out ahead of his competitor who only thinks he knows.

VARIETY OF MANAGEMENT PROBLEMS.

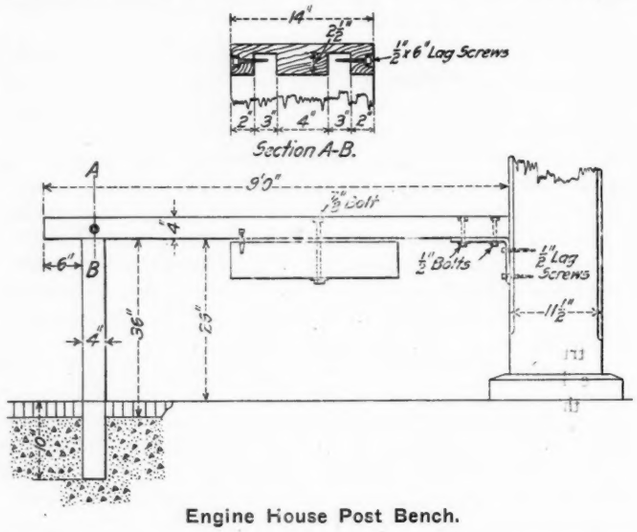
Systems of management are necessarily as various in their details as the business conditions which have to be met. The simplest condition is that of a concern manufacturing a thoroughly standardized product which, under no circumstances, will be adopted or modified for special use. As a business policy this may be carried too far and the product may be out of date before the fact is realized. In such a business, however, at one sweep, many of the difficulties experienced by general engineering concerns are disposed of and attention can be concentrated on a limited number of definite problems, the satisfactory solution of which may be attained by gradual and experimental stages.

In a class by themselves are problems like ship-docking and *repairing and locomotive overhauling where the time during which a large investment is earning nothing is a governing consideration.* Between these extremes, namely, where cost is the determining factor on one hand and speed of completion on the other, there are all possible variations, no half dozen of which could be efficiently managed on precisely the same system.

It may be emphasized here that the underlying practical motive of our system is not indiscriminate speeding at the expense of the workers, but the securing by co-operation of the economies obtainable through either anticipating, or locating and removing all wasted time and ineffective or unnecessary effort and expense, whether clerical, manual or mechanical. It is directed towards enabling employee and capitalist alike, under the most favorable conditions to make the most of the opportunities of the working day and in so doing a very large part of the usual burden is removed from the shoulders of the employee and placed upon the organization.

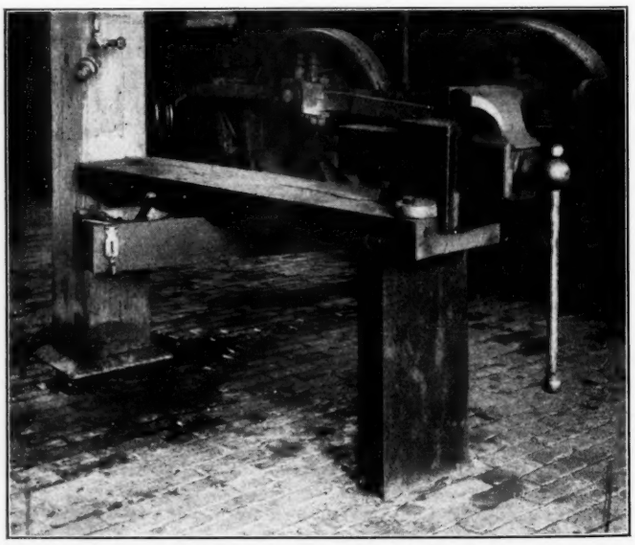
POST BENCH FOR ENGINE HOUSE.

There is usually very little bench room in an engine house and the work benches are generally placed where they will be as little in the way as possible. The illustrations show a post bench designed by J. E. Tisdale, general foreman of the Chicago



Engine House Post Bench.

& North Western shops, Huron, South Dakota. The convenience, utility and inexpensiveness of this type of bench are apparent. The location of the benches near the sides of the loco-



Post Bench for Engine House.

motive makes the fitting and filing of side and main rod brasses a much easier task. The drawers are hung and swung on a bolt which passes through the center of the bench and drawer, allowing either end of the drawer to be opened toward the workman.

FREIGHT CAR TRUCK EXPERIMENTS.

The extensive series of tests of the friction of loose and rigid freight car trucks on curves, which was made by Prof. L. E. Endsley for the American Steel Foundries Company, was fully described in the *Railway Age Gazette* of March 24, 1911, page 691. At the September, 1911, meeting of the Western Railway Club, George G. Floyd, chief mechanical engineer of the American Steel Foundries Company, presented a paper in which he described some of the incidental features or "side lights" of the tests, which were not considered in the original report. The following abstracts are taken from his paper:

After the investigation of the square and loose trucks in service and before the testing plant was built, we had formed certain conclusions as the result of the investigation, as well as some opinions based upon the statements, experience and judgment of several railway mechanical engineers. While these conclusions and opinions had to be revised somewhat after the tests were run, our conclusions were in the main correct as to theory and as to what the results might be, and had to be revised only because the material effects had been somewhat underestimated. It did not take long to discover that trucks in service did get out of square; that is, in rounding a curve the side frame on the inside of the curve would move ahead of the frame on the outside of the curve. Just how much was a matter of doubt, or a matter of calculation, rather than of actual measurement. The greatest amount that any one suggested was 1¼ in. We were hardly prepared to find that it was nearly as much as 3 in.

We had expected to find that there might be 10 to 15 per cent. difference between the curve friction of loose and square trucks. We found as much as 150 per cent. between the best square truck and the worst loose truck. We had anticipated that the load on the truck and its speed would regulate the amount the truck would go out of square, but it seems from the tests that the truck will go out of square approximately the same amount every trip around the curve, regardless of its weight and speed. In fact, when it was merely pushed around the curve, slowly by hand, it would go out of square the same amount as when it went around it at high speed.

It was evident—as each truck tested went out of square an amount peculiar to itself—that there was something about its construction that acted as a stop to prevent further movement. Probably a wedging of the axle against the opening in the back end of the box and against the wedge and brass. It was noted, in that type of arch bar truck in which the columns were riveted securely to the channel, that the truck went out of square a less amount than those trucks in which the columns were bolted to the channel. This riveting of the column to the flanges of the channel made one less loose joint, and it may be that this one less loose joint introduced a stop at the columns, or column bolts, which brought the truck to a bearing in advance of the stop furnished by the journal and box. There was also found an indication that the longer a truck was in service, the more it would go out of square, this being no doubt due to a wearing away of the parts that stopped further movement of the truck, as well as a gradual loosening of the parts tending to hold the truck square.

An interesting experiment was made to determine what effect the time of service would have upon those parts of an arch bar truck that are supposed to hold the truck square. A car was accidentally found in the yard that had been out from the contract shop less than a month. It had a 50-ton truck of heavy construction and cast steel truck columns bolted to a heavy channel, with two long bolts reaching through both columns. These bolts were tight, as were all bolts about the truck. The truck was put on the testing plant and showed a very good test, one side frame moving ahead of the other only ¾ in. A duplicate of this truck in service one year showed a movement of a trifle over 1¼ in., and another in service 8 years showed almost 2 in. movement. When trucks are new, all the surfaces bolted together being rough and the bolts tight, the friction between the parts will prevent all but a slight movement. It is this small initial movement of the parts that brings about the final general looseness of the whole construction. The high points of the rough joint wear away, allowing the bolts to become loose, and then there is a still greater loosening of the parts in general by abrading, polishing or wearing away of the parts by friction. A bolted joint of this character is probably successful only when it is possible to so design it that all initial movement will be prevented.

It only takes a small movement of the spring channel to give a considerable motion to the side frames, one ahead of the other. One-sixteenth of an inch motion of the channel under the spring seat will allow the side frame at the opposite side of the truck to move forward or backward about ¾ in. to ⅞ in. That this initial motion exists in an arch bar truck, even when new, is not surprising when it is considered that the holes through the upturned flange of the spring channel for the horizontal column bolts are drilled 1/16 in. larger than the bolt, the holes in the arch bars are drilled 1/16 in. larger than the column bolts, and the hole through the column is cored usually ⅛ in. larger than the bolt passing through it—a possible 3/16 in. to 5/16 in. looseness to start with in the fit of the bolts. One does not have to look far to find reasons why the arch bar truck is a loose truck.

The fact that the arch bar truck does get out of square on a curve, the movement increasing with the age of the truck, probably accounts for the trouble and expense for the upkeep of columns, column bolts, spring plank, bolts, etc. There is a continual motion and straining of parts at this point. It is impossible to keep the bolts tight, and it is quite natural that the repair account should be heavy if the joint is to be kept up; it is quite natural also, if the joint is not kept in proper repair, that the truck will fail to give the expected service results.

The tests demonstrated that a bolted connection between the spring channel and one-piece cast-steel side frame, was of little or no value as a means for making a tight immovable joint that would hold the truck in square. The bolts were invariably found loose, and even after being tightened up thoroughly just before running a test, the joint, after a few runs, would loosen. An extended examination of cars in service indicated that the bolted connection was of little value, as the bolts were nearly always found loose. On the other hand, an investigation covering a period of almost two years, and including several thousand cars, showed that the riveted joint was developing no signs of looseness, and was performing well the duty for which it was designed.

Reducing the results obtained on the test track to a 5½ deg. curve brings out some interesting and startling information. A 5½ deg. curve is selected because it is possibly an average curve, and also because it makes a division by an even divisor. The small fractions are left out, in order to make round numbers. The draw bar pull in pounds per ton is found to be 9½ lbs. for the best square truck; 13.7 lbs. for the worst square truck; 11 lbs. for the best loose truck, and 17 lbs. for the worst loose truck. Broadly speaking, the difference between the square and the loose truck is due to a difference in truck construction. The difference between the best and the worst square truck is due almost entirely to the wheel condition. In tabulating the results, as a matter of convenience, all trucks that went out of square ½ in. or less were classed as square trucks, so the difference in friction between a truck absolutely square and one out of square ½ in. should be deducted from the total difference between the best and the worst square truck—the balance is chargeable to wheel condition. However, the difference between a truck square and one out ½ in. is a small amount. This fine line was not conclusively drawn in the tests, because of lack of time. It was reserved as one of the refinements to be run down in this year's test.

The difference between the best and the worse loose truck is

probably evenly divided between that due to truck construction and that resulting from wheel condition. The difference between the best square and the best loose truck is favorable to the square truck by 15.8 per cent.—and as between the worst square and the worst loose 24 per cent. in favor of the square truck. In both cases the difference may be said to be difference in truck construction. As between the best and the worst square truck, the difference is 44 per cent., largely wheel condition. Between the best and the worst loose truck, there is a difference of 54 per cent., possibly somewhere near evenly divided between truck construction and wheel condition. Between the best square truck and the worst loose truck is a difference of 79 per cent. The difference between the worst loose truck when run as a loose truck, and the same truck squared and run as a square truck, was somewhere near 40 per cent. in favor of the square truck, this difference being entirely due to truck construction.

The figures just given are from specific tests of specific trucks, and it is hardly correct to undertake to construct a series of averages from them when it is considered that the averages used in calculating train resistance for actual service must of necessity represent the average resistance of all trucks, as they come in service. Therefore, it might be well to state that the average difference between all the square trucks and all the loose trucks tested was approximately 24 per cent. in favor of the square truck, based on a 5½ deg. curve.

When the theory and reasons are known, it is not surprising that the curve friction of a loose truck should be greater than that of a square truck. Some very interesting experiments were made by whitewashing the rails on the curve and noting the difference in contact between the wheel and the rail with the truck square and loose. When a truck was run square, there was only one point of contact between the wheel and the rail. This was on the ball of rail and in the deep part of the throat of the flange of the wheel. When the truck was run loose, there were two distinct points of contact, one on top of the rail and one on the side of the rail, there being from ⅛ in. to ⅜ in. between these two lines, depending on how much the truck went out of square. In this case the whitewash was left on the ball of the rail, and the throat of the wheel did not show any contact with the ball of the rail. When the truck was stopped on the whitewash and run back the end of the mark on the side of the rail made by the flange was from 1 in. to 2½ in. in advance of the end of the mark on top of the rail, made by the tread of the wheel. It could be seen by sighting along the edge of the rail when the truck was in this position, that there was no contact between the throat of the flange and the ball of the rail.

When the square truck was rounding the curve, the throat of the wheel being in contact with the ball of the rail, and the axles square with the track, the outside wheel would climb up on the rail, enlarge itself an amount sufficient to make up for the difference in the length of the inside and outside rails, and the wheels would go around the curve without slipping—the friction being all rolling friction. But when the truck was running as a loose truck and got out of square, the throat was not in contact with the ball of the rail, and the flange being in contact with the side of the rail, acted as a shoulder so that the wheel could not move over onto the throat and climb the rail. Therefore, either the outside or the inside wheel had to slip the difference between the length of the two rails.

When the truck is running square the friction between the wheel and rail is rolling friction. But when the truck is running loose and gets out of square, there is just as much rolling friction as there was before, and in addition there is the sliding friction between the flange and the side of the rail, which must be considerable, and the slipping or sliding of the tread of the wheel on the top of the rail, this because of the difference in the length of rails, and the inability of the outside wheel to enlarge itself, owing to lack of throat contact with the ball of the rail. This was plainly noticeable by listening to the noise the truck made in going around the curve. When the truck was square it made just a single rumbling noise quite natural to a vehicle of this kind, but when running loose, in addition to the ordinary rumbling noise could be heard a loud flange song, and a distinct high sounding and piercing noise caused by the tread slipping on top of the rail. This latter noise was not a continuous one, but an intermittent noise, with very short intervals. The flange song was continuous.

There is also one other source of increased friction in the loose truck—the sliding friction. When a truck is running out of square, the axles are not square with the track; therefore, the wheels are not revolving in a plane parallel with the direction of the rails, and if it were not for the flanges, the tendency of the wheels would be to run to the right, or the left, as the case might be. The natural track for the wheels to make would be one diverging from the rails, and they would only track in a line with the rails by a certain amount of slipping. This point can better be illustrated perhaps by presuming the front wheels of a wagon turned the necessary amount to go around a street corner, and then locked in this position. One can readily see it would require an extra effort on the part of the horses to pull the wagon in a straight line, with the front wheels so turned and locked. The front wheels would revolve, but much slowed than the rear wheels, and they would also slip along the pavement.

It must be this slipping that causes the increased friction in loose trucks going out of square from nothing up to 1 in., and before the flange begins to make a contact with the side of the rail. It will be noticed from Professor Endsley's report, that there is a big jump in the friction between an inch, and 1½ in. out of square. It is thought that the increase in friction up to 1 in. out of square is caused by the gradual increase in the slipping action just noted above, and that along about this point is where the flange begins to make the sliding contact against the side of the rail.

It might be said that these tests, as they deal almost entirely with curve friction, do not interest the road that has almost all of its mileage straight track. This would be taking a somewhat narrow view of the matter. Owing to the great exchange or interchange of cars between the different railways, it is possible that the man on a road full of curves would be very much interested in the kind of a truck his straight track neighbor put under his cars.

It is not the idea that these tests are final, nor that they represent absolutely service conditions. They were given out merely for what they are worth, and in so far as they go. They are considered as a preliminary to a more serious test that it is hoped will be made by the railways themselves. It is felt, however, that the tests are a close approximation to what will be found in actual service, and are of sufficient value to be entitled to full consideration, pending more elaborate dynamometer tests in actual service.

These tests were run on a curve somewhat sharper than is found in ordinary main line track, with the idea that the differences would be more easily measured. After the season's work was finished and the results tabulated, it was decided to continue the work again this summer, with the view of determining, if possible, several things that could not be determined with a single curve.

There was considerable work laid out to be done, but it could not be finished last year. It was desired to carry on a somewhat different line of experiments, for which several curves seemed a necessity; therefore, the test track was entirely rebuilt, and a 3 deg., a 6 deg., and a 12 deg. curve added. The 3 deg. and the 6 deg. curves were laid with both new and old rails side by side, an arrangement having been made with the Missouri Pacific allowing the old rails to be taken out of service on main line 3 deg. and 6 deg. curves. This summer's work is not yet finished. It is expected that the plant will be in operation until the cold weather.

CAR DEPARTMENT KINKS.*

BY C. C. LEECH,

Foreman, Pennsylvania Railroad, Buffalo, N. Y.

HAIR PICKING MACHINE.

The hair in the coach seat cushions becomes pressed down and matted together after long service, and when the cars come to the shop for repairs it is necessary to remove it from the cushions and to thoroughly pick and pull it apart before replacing it. The machine shown in Fig. 1 has given very effective service in the performance of this work. It consists of a strong wooden framework carrying the wooden drum *D*, which is studded with a large number of pointed steel pins, as shown. At one end of the shaft on which the drum revolves is a pulley *A*, which is belted to the countershaft. Mounted on the same shaft as pulley *A* is gear *B*, which engages the gear *C*, and thus drives gear *E* on the end of the lower roller *R*, which is shown in the upper right-hand corner of the drawing. Another gear on the opposite end of roller *R* engages a gear which is mounted at the end of the shaft of roller *RR*.

The wooden drum is revolved in the direction indicated by the arrow in the lower left-hand illustration, and the rollers, which are driven by the trains of gearing, revolve in opposite directions and toward the drum. The hair, which is fed into the rollers from the table or trough *T*, comes in contact with the pins on the drum and is torn apart and separated. It passes over the drum and falls into a box underneath. The lower roller runs in boxes which are secured to the frame. The pressure between the rollers is controlled by the springs *S*, and may be adjusted to suit the conditions.

*These kinks are part of the collection that was submitted by Mr. Leech in the shop kink competition which closed May 15, 1911, and in which he was awarded the first prize of $50.

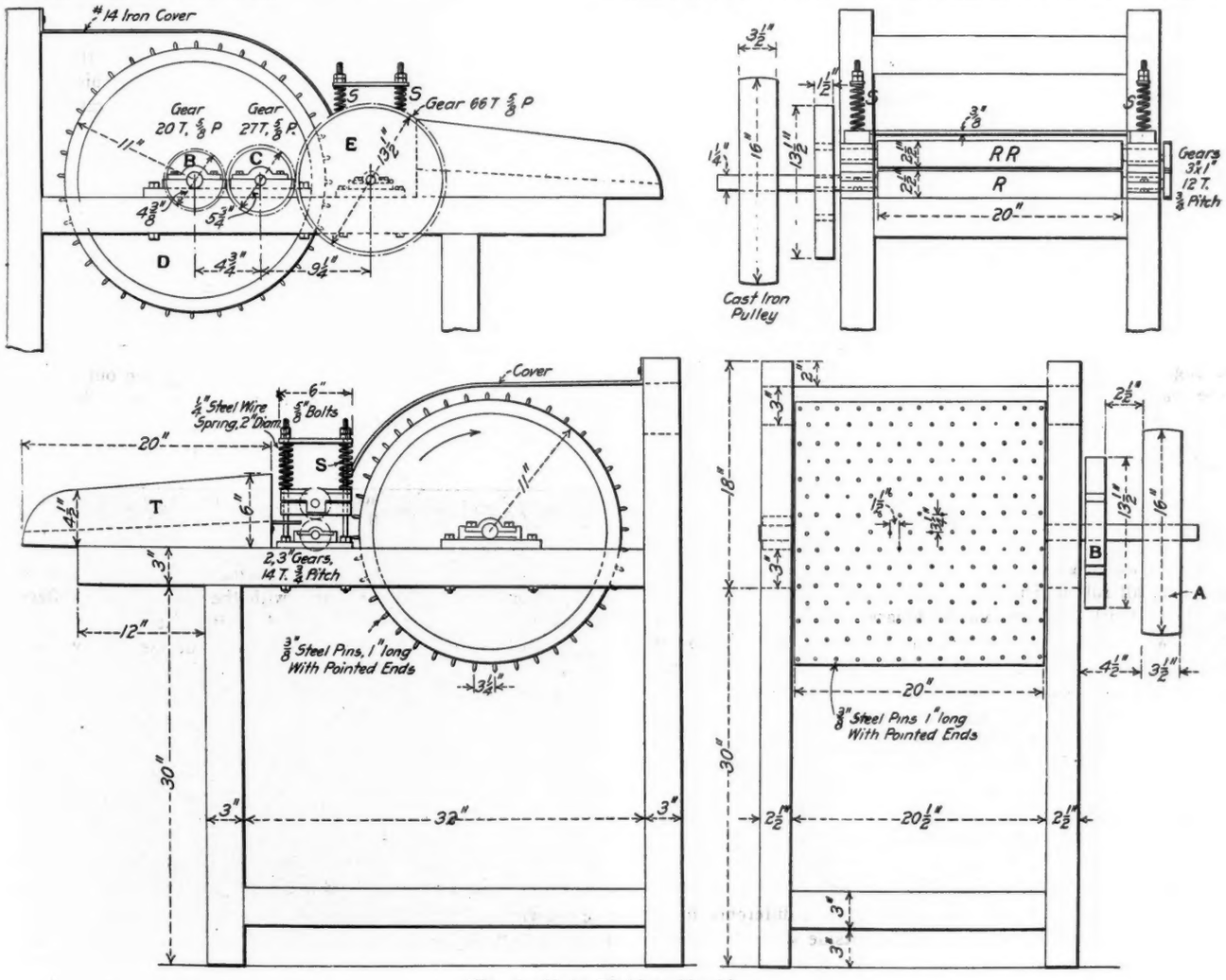


Fig. 1—Hair Picking Machine.

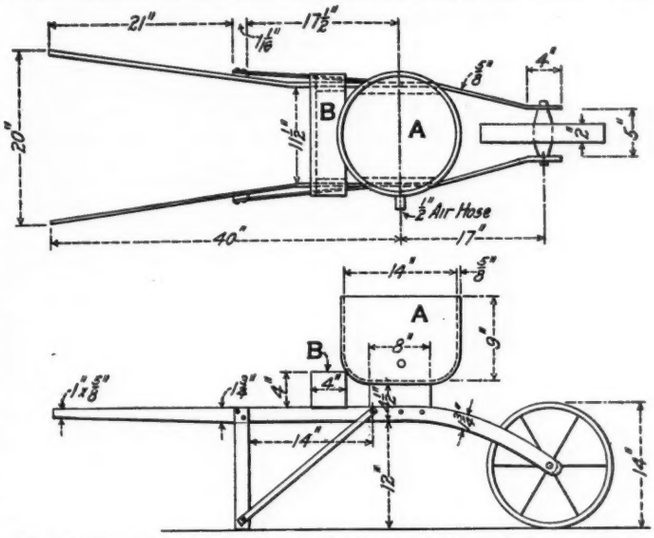


Fig. 2—Portable Rivet Furnace for Steel Freight Car Repairs.

PORTABLE RIVET FURNACE.

The fire pot, *A*, of the portable rivet furnace, which is illustrated in Fig. 2, is made from one-half of a 14 in. brake cylinder.

It is securely bolted to the 5/8 in. x 1¾ in. framework. The small box *B* is provided for holding the rivets. This forge has given very good satisfaction in connection with the repairing of steel freight cars.

ICE TONGS.

A simple but efficient pair of ice tongs, used by car cleaners or attendants when filling the water coolers in passenger cars, is shown in Fig. 3. They are made of 1/16 in. x ½ in. spring

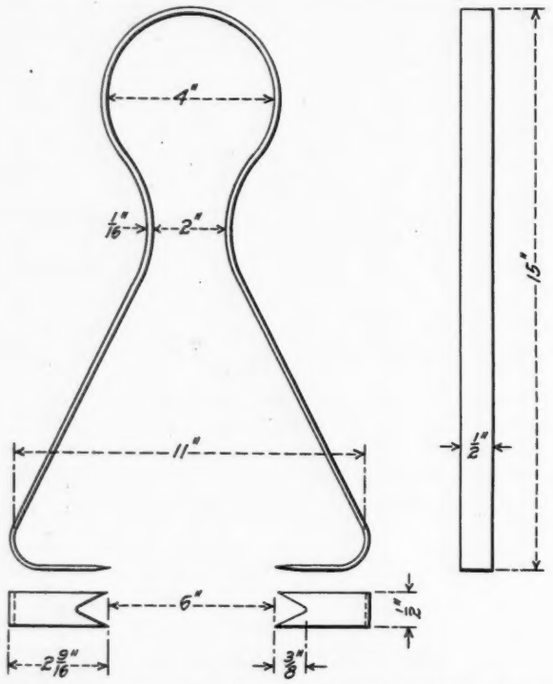


Fig. 3—Ice Tongs for Passenger Car Water Coolers.

steel. After the ice has been broken into lumps of the proper size the tongs are used for handling it while it is being washed and for placing it in the cooler, thus making it unnecessary for the operator to touch it with his hands.

The results of impact tests on riveted joints are given in *Der Eisenbau* of September by E. Preuss. Three small rectangular plates were rivited together, the middle plate being raised above the two outside ones so that it would be struck by a ram while the other two rested on an anvil. The slip of the middle plate beyond the outside plates was measured for the different impact blows given by raising the ram at varying heights and for various repititions of the blow. Static pressure tests were also made for comparison. From these tests the author arrived at the following conclusions: The slip produced by a blow of given striking energy is only slightly increased by repeating the blow. The slip is, roughly, a linear function of the energy of impact. In contrast herewith, in static tests the slip is a higher function of the loading. For the same impact energy per square inch of rivet-shear section, the slip was greater for larger (1-in.) rivets than for small (11/16-in. and ⅞-in.) rivets. To produce a given amount of slip, the required static load in pounds is 8,000 to 22,000 times as great as the required impact energy in foot-pounds. This figure is greater for large rivets than for small, and is smaller for a great amount of slip than for a small amount.

An express train made a trip between Munich, Germany, and Nuremberg, a distance of about 123 miles, in two hours and fifteen minutes, or at an average rate of about 55 miles per hour. Over certain sections of the road a speed of 65 miles per hour was attained. This is said to be the fastest train in Germany.

SHOP KINKS.*

BY W. H. SNYDER,
Assistant General Foreman, New York, Susquehanna & Western, Stroudsburg, Pa.

One of the following kinks is for use in the erecting shop or engine house, one for the boiler shop, and the last two for the car department.

DRILLING DRIVING WHEELS FOR HUB PLATES.

The clamp shown in Fig. 1 is used on a driving axle to support the end of a ratchet or air motor when drilling the driving wheels for hub plates. It is undoubtedly as important a time saver as any device of its kind. The great advantage over kinks which

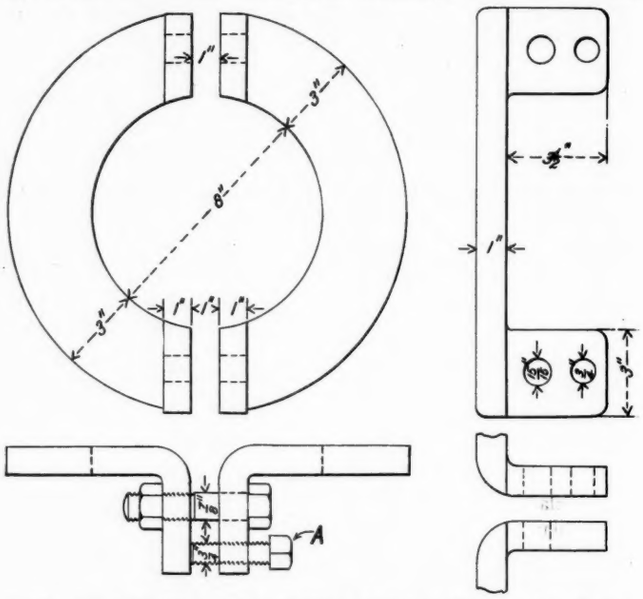


Fig. 1—Axle Clamp for Drilling Driving Wheels for Hub Plates.

have been used for this purpose is that all of the holes may be drilled with one setting of the clamp, whereas other devices usually have to be adjusted for each of the holes, thus wasting a considerable amount of time. In applying the clamp to the

*Entered in the competition which closed May 15, 1911. Mr. Snyder has contributed a number of collections of kinks since the Shop Edition was inaugurated; they will be found in the issues of November 5, 1909, page 878; January 7, 1910, page 37 (second prize); March 4, 1910, page 491, and July 7, 1911, page 41. He was also awarded the first prize in the car repair kink competition which closed December 15, 1910; the collection will be found in the issue of January 6, 1911, page 21.

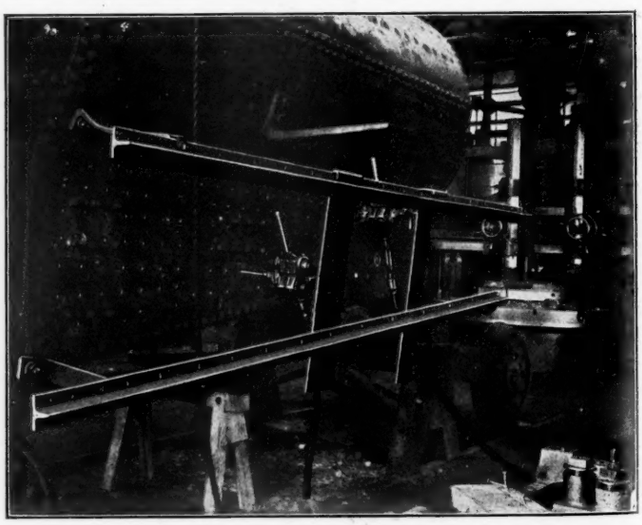


Fig. 2—Application of Device for Drilling Out Staybolts.

axle the set screws *A* are adjusted so that it will stand square when the bolts are tightened.

DRILLING OUT STAYBOLTS.

A handy arrangement used in connection with the drilling out of staybolts on the outside of a locomotive boiler when applying a new fire box, is shown in Figs. 2 and 3. The device will be found especially useful in a small shop where the facilities are limited.

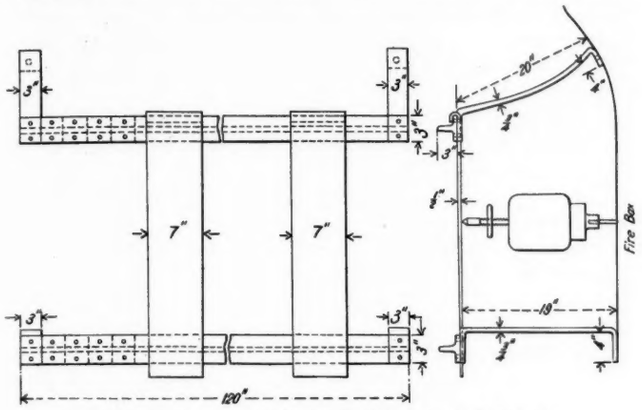


Fig. 3—Device for Use in Drilling Out Staybolts.

The uprights, which are 7 in. wide, are adjustable and may easily be moved along the framework. It is also possible to use several air motors at one time. The frame may be adjusted for different lengths of boilers by drilling a number of holes at one end, as shown on the drawing.

LIFTING CAR WHEELS.

The clamp shown in Fig. 4 is convenient for lifting car wheels or similar parts having holes through them near the centre of gravity. When the end of the clamp has been inserted through the hole the construction is such that any tendency to lift it will separate the ends of the clamp, and the harder it is necessary

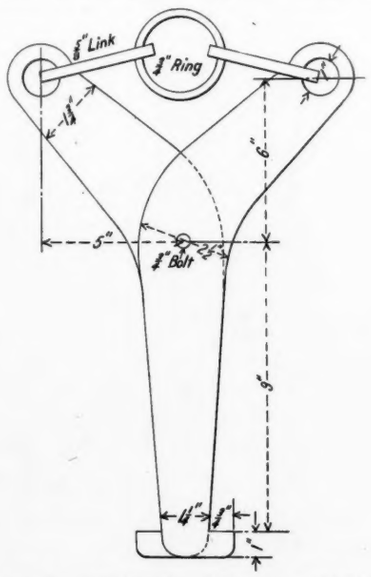


Fig. 4—Clamp for Lifting Car Wheels or Similar Objects.

to pull in order to raise the object, the tighter it will grip it. The clamp illustrated will go through a 2½ in. hole, and can be used in a hole as large as 10 in. in diameter without any danger of slipping.

FITTING SPRINGS IN ARCH BAR TRUCK.

A clamp, or press, for drawing down the tender truck springs preparatory to fitting them in an arch bar truck is shown in Figs. 5 and 6. It is a great time saver where much of this work is

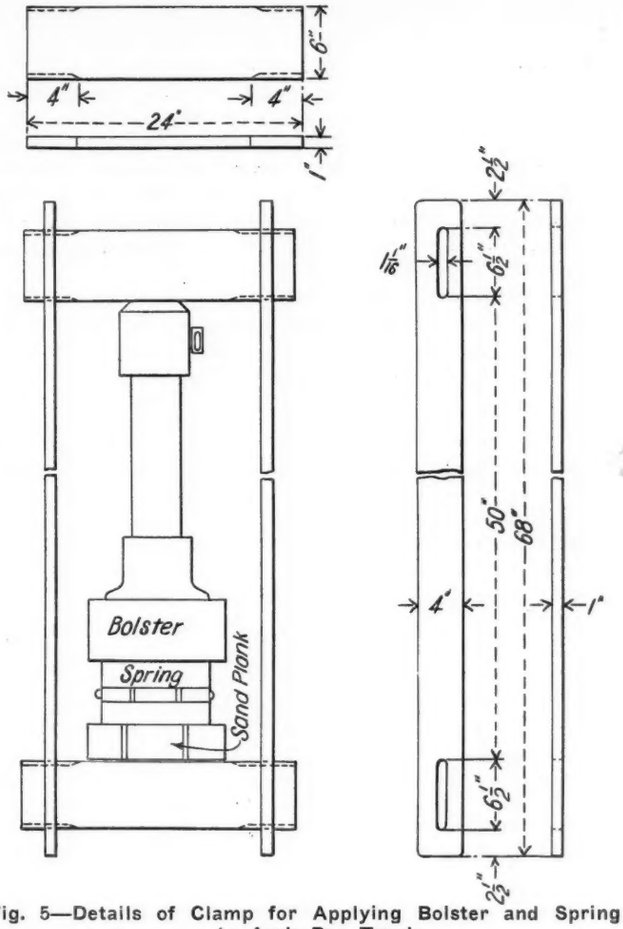


Fig. 5—Details of Clamp for Applying Bolster and Spring to Arch Bar Truck.

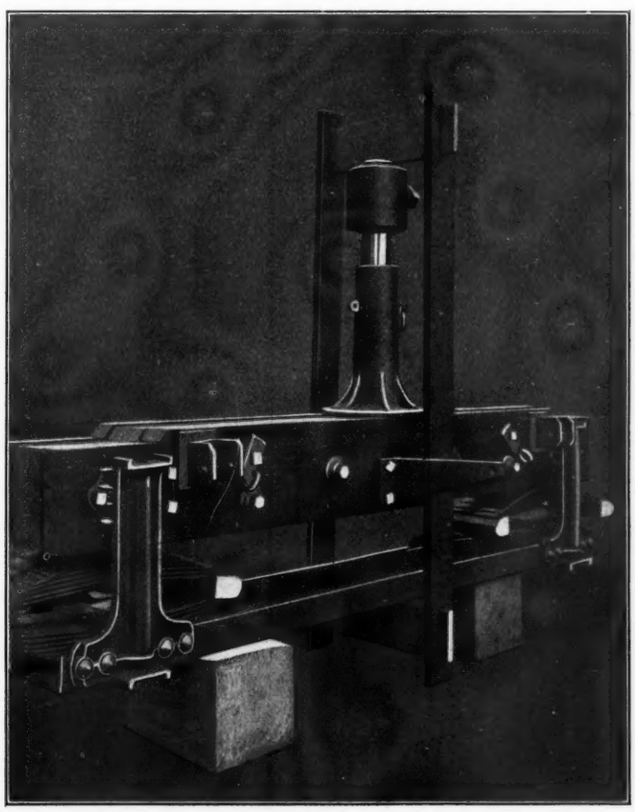


Fig. 6—Forcing Down the Bolster and Spring Preparatory to Fitting Them in an Arch Bar Truck.

to be done, and is simple and inexpensive in construction. The jacket is placed above the center of the bolster and the framework is slipped over it. The jack is then operated, forcing the bolster and the springs downward, as shown in the photograph. The arch bars are put in place and the column bolts are applied and drawn up tight, after which the jack is released; the clamp may be easily and quickly removed. A considerable amount of hand labor is done away with by its use. When overhauling a truck, and only one side requires drawing down, the device may be placed over the end of the bolster and operated as described above.

LOCOMOTIVE REPAIRS.

BY R. B. VAN WORMER,

General Foreman, Atlantic Coast Line, Waycross, Ga.

The Waycross, Ga., shop of the Atlantic Coast Line makes all of the heavy general repairs to locomotives on several divisions and outlying points of the system. The following method of handling these repairs, which has been worked out by careful study and experiment, is giving splendid results. As soon as it is decided to shop an engine for general repairs, and while it is still in service, the master mechanic sends in a detailed report of all the necessary repairs. This report also includes a similar statement from the engine house foreman, or general foreman, in direct charge of the engine, and frequently from the engineer. When the report is received at the shop it is used as the basis for another report, or bulletin, which covers all of the repairs which are needed, and also information as to parts which may have to be changed to new standards, or examinations of any appliances which are being tested, etc. Copies of this bulletin are distributed to all of the foremen so that they may prepare such new parts in advance as may be necessary.

The advantages of these reports have proved greater than was anticipated. In addition to cutting down the length of time required for repairs the individual characteristics of each locomotive are carefully studied by all concerned, and the tendency is for a more thorough inspection at outlying points both before and after the engine is shopped. The general foreman and engine house foreman on the division where the locomotive is used feel that the general repairs will be based more or less upon their inspection and the report which they send in. After the engine comes from the shop they examine it more carefully and comment or criticize accordingly. The repair shop management has the advantage of knowing in advance of defects in invisible or inaccessible parts, such as leaky dry pipes, cracked mud rings, etc. It also realizes that its work will be subjected to close inspection after it leaves the shop.

These reports often indicate parts which were repaired and placed in good condition a short time before the engine was shopped, and therefore do not need any attention. As each department keeps copies of the reports on file they can readily ascertain, the next time the engine is shopped, whether the repairs which they made have given proper service or not, and where improvements may be made in the methods of handling the work. As soon as the engine is shopped the time scheduled for making the repairs is shown on the usual bulletin boards, and a bulletin is also issued to each department, the first of each week, giving a list of all the engines which are scheduled to leave the shop that week, and those which are expected to be sent out the following week. If, for any reason, a department finds that it cannot complete its share of the work in time it is expected to communicate at once with the general foreman's office. The bulletins not only serve the purpose of preventing one department from delaying the other, but all departments tend to keep the pace set by the one which is the most advanced with its work. As each bulletin covers a period of two weeks, it is possible to revise the second week if it is found possible to improve on the schedule. One of the main essentials of any well regulated shop is that each department be evenly balanced in good management and facilities for performing its part of the work.

The work done on an engine is confined, as far as possible, to applying repaired or new parts already on hand, as rapidly as the removal of the worn parts will admit. A clear distinction is made between the force which is utilized in removing and applying the parts and the force which is used in repairing old parts and manufacturing new ones. This theory, of course, cannot always be carried out in practice, especially where unusual boiler repairs are required, or when engines other than standard are repaired. However, the repairs are always carried on with this end in view. The success of the work depends to a great extent on how far the work can be specialized and the parts standardized.

The erecting and dismantling gangs in the erecting shop are subdivided into groups, each of which has a certain class of work to take care of for a certain section of the shop. One man is held responsible for the quality of the work and the time required for each operation. He is paid the same rate as the other mechanics, but is of the progressive type, willing to assume responsibility and leadership in the realization that his efforts will be appreciated. This practice applies to repairs other than those to the machinery; for instance, certain boiler makers are detailed for removing and applying tubes, staybolts, front end arrangements, ash pans, grates and riggings. Certain blacksmiths are detailed for the work that is to be done in the erecting shop, including thermit and oil welding, straightening frames or tail-bars in place, etc. Other men are detailed to remove and apply pilots, running boards, cabs, boiler lagging, jackets, etc.

The work is specialized to an even greater degree in the repairing or manufacturing of locomotive parts; each machine or group of machines has its particular work to perform and, as far as possible, the machine tools are arranged with a view to the work which is to be assigned to them. The smith shop is divided into groups of one or more forges, each of which has a certain class of work to perform.

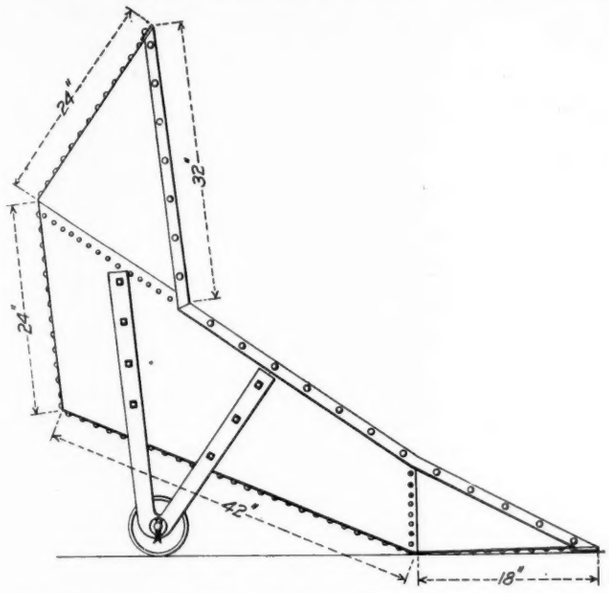
As the overhauling of the locomotive is handled by numerous groups, each of which, as far as possible, is in charge of a leading man, it is possible to locate the weak points at once and to gradually eliminate them, for the leading men are in position to know and understand at all times exactly what work is required and when. It is desirable to reduce the time that each engine is out of service to a minimum, and what is known as "working stock" is maintained for use in cases where exceptionally heavy repairs have to be made to certain parts. This working stock consists, in addition to the ordinary interchangeable parts, such as driving boxes, shoes and wedges, eccentrics, straps, tubes, frame bolts, etc., of engine trucks complete, tender frames complete with trucks, cabs, running boards with brackets, locomotive jackets, electric lighting outfits complete, ash pans, brake rigging, spring rigging, rods, pistons, etc. Whenever any part of this working stock is used the parts which it replaces are repaired and replaced in the working stock, thus preventing an accumulation of surplus stock. While most gratifying results have been obtained from the above methods, they are considered merely as a preliminary movement into a large field of opportunities.

There are 30,000 men employed on the Ichang-Wanhsien Railway, China, and construction trains are working out of Ichang, on the Yangtse Kiang river, for several miles. One tunnel, 1,000 ft. long, has been holed through, and another 6,000 ft. long is under way. The earth work is well up to Kweichow, a distance of 100 miles. At Ichang machine shops and station buildings have been erected. The line runs inland from Ichang and comes out at the Yangtse-Kiang river near Hsiang Chi, about 90 miles distant. It then follows the river for about 30 miles, when it will again go inland along a route which has not yet been definitely determined upon.

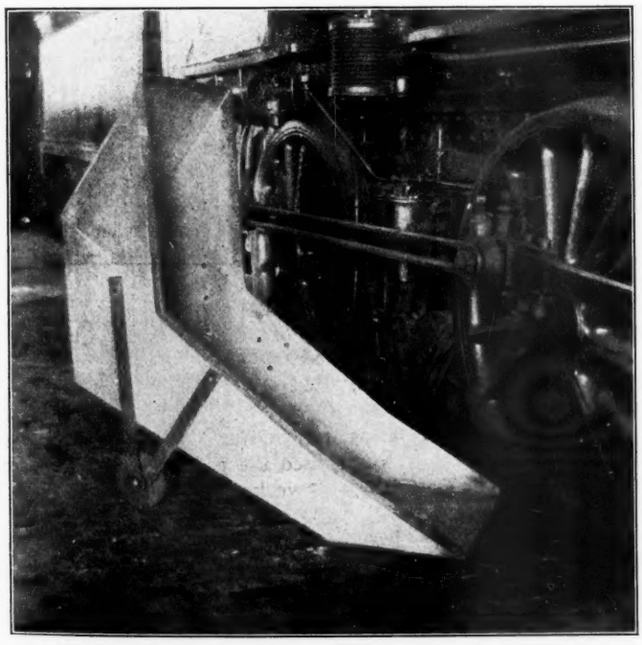
WATER DEFLECTOR FOR DRAINING BOILERS.

BY F. W. BENTLEY, JR.,
Chicago & North Western, Huron, South Dakota.

Many engine houses are not equipped with boiler blowing off lines, and the wash-out plugs are often pulled when a considerable amount of pressure remains in the boiler. The water leaping from the hole often drenches the nearest locomotive and floods the engine house floor. The accompanying illustrations show the details and construction of a deflector 28 in. wide, that may be made of galvanized iron at a reasonable cost. The edges are reinforced by ⅜ in x 1 in. strips. With this device in front of the plug hole the water is diverted back into the pit, leaving the floor and surrounding objects dry and undisturbed.



Galvanized Iron Water Deflector for Draining Boilers.



Water Deflector for Draining Boilers.

The Argentine government has ordered the Cordoba Central, 805 miles long, to install block signals throughout its line. It is estimated that the cost will be $117,000.

HANDLING MEN.

"Where there be many men, there be many minds," and often there are many ways of accomplishing the same results. This is perhaps as true in the matter of handling men as in any other human activity. But in these days of struggle for efficiency it may be of interest to take an example from practice and show the methods of a man who has been notably successful, not only in the physical results achieved, but in the interest, real live vital interest, that he has succeeded in creating among his subordinates. He works toward the accomplishment of five ends; an awakening of an interest in the success of the employing company, a pride in the work done, a personal loyalty toward himself, an increase in the skill and value of the individual and a knowledge that all of this makes for the personal advantage and advancement of the individual employee.

To do this implies that the man making the effort is built on broad and generous mental lines. He must feel the same interest in the welfare of his employers as though he owned the plant and its whole profit would accrue to him. He must take a personal pride in the character and quality of the output, the appearance of the plant and its efficiency. He must feel the same loyalty toward his board of directors that he hopes to arouse his men to feel for himself. He must be free from the sense that he has learned all that there is to know, but must continually struggle for more light, whether the lamp be held by a savant, or a sweeper of the shop floor, and he must be generous to let these be the controlling factors, regardless of his knowledge that they all make for his own profit and advantage.

Then, above all and through all, the man must "to himself be true, for thence it follows as the night the day, he can not then be false to any man." And this means a scrupulous keeping of a word once pledged.

He was only an assistant superintendent, let us say in a car repair shop, and he felt that it was quite possible to increase the output without increasing facilities. Work was being done by piecework and contract, but the contracting foreman seemed unable, or was it unwilling, to increase his output. So the assistant superintendent called him in. First he cleared his office of every one. And then:

"John, do you trust me?"

"Why yes, I think I do."

"I don't want you to think. Is it 'yes' or 'no.' ?"

"Why, I believe I trust you."

"No thinking or believing, is it 'yes' or no.'?"

"Yes."

"Then, this is the case. I am not satisfied with the number of box cars you are turning out. You can do better, but you are afraid to, lest I cut the price. Now, if you will go ahead and do your best, the present price shall stand for six months. Make all you can out of it, and then we'll consider a revision."

And John went, and soon box cars began to jump out of that shop from every nook and crany. They piled up. They filled the yards, and John's pay went up by leaps and bounds. Then the assistant was called in.

"Do you know what John is making?"

"Yes."

"Do you know that he is making much more than you?"

"Yes."

"Well, it won't do; it won't do. That price on cars will have to be cut."

"It can't be done. I have given my word that the present rate shall stand for six months.

"You had no right to do it. He is making too much money. The price must be cut?"

"It can't be cut. The cars are costing no more than they were, and you were satisfied. If the price is cut, I resign to take effect with the cut."

Again and again the same conversation took place until our man turned.

"That price can't be cut, you owe me $3,000. Take it and pay yourself out of it every week, as much as you think John is overpaid. And when it is gone, I'll give my notes to make it up to the end. I gave my word that the price would not be cut, and it won't."

The man was too good to lose, and so they fumed and fretted, but let it stand and John went on getting pay checks that dazzled him with their size. The fuss had been so great that seven months instead of six were allowed to pass before John was called in.

"Been doing well?"

"Great."

"Well the time has come for a cut."

"Yes, it really came a month ago."

"What shall it be?"

"Make your own figures, and I'll take them."

So ten dollars were cut off here and fifteen there, and twenty in another place, still leaving John's possible pay well above what it had been under the old regime, and the company saved money by the barrel when the saving once began. The assistant superintendent's reputation as a man of his word was established. The company got credit for being square, John's loyalty was assured and the cost of the output was dropped by a goodly percentage.

* * * * * *

He was in the foundry one day. The foreman was not very progressive. Timid, perhaps, because of ignorance.

"Don't you think you could use a molding machine on those cores?"

"No, no use to me."

"They've got one down at the ——— shop. Have you ever seen it work?"

"No. Their work is different."

"Better go down and look at it, just to satisfy a curiosity that you ought to have."

Ten days elapsed.

"Have you seen that molding machine down at the ——— shop?"

"Yes, but I hardly think I could use it."

"Couldn't you use it on that core?"

"Possibly. But I don't think we would save anything."

So it went on. The superintendent set that foundryman thinking for the first time in his life, and then kept him at it. Core after core was called to his attention, until at last——

"Oh, well, boss, if you want to get that machine, get it and send it along."

"Not much. If you want that machine you've got to ask for it."

But the man was thinking. He began to calculate what the machine would save. He watched the other fellow, and saw that he was being beaten, until one day:

"I say, boss, I wish you'd get one of those machines for me, I can make it work, and do it well."

It was no longer the boss' machine. It was the foreman's. His pride made it a success. It was his. He had asked for it, and it simply had to make good. And it did.

* * * * * *

"What's the use. If I get up anything, the boss claims the credit for it; the company steals it and cuts prices, and I am just where I was before, or worse."

Our man didn't want his men to reason that way. The National Cash Register Company set the example years ago, and it seemed good to him. He didn't want credit for another and poorer man's ideas. He didn't like to have it thought that his company was dishonest. So he said that he would pay for suggestions that were adopted, and suggestions began to drop in. Not patentable suggestions to be sure, but real money savers. An inclined plane for handling crankpins, a method of setting out teeth in a saw, a scheme for straightening bent rods. After that the man would go down the shop with head in the air and say:

"That's mine. The boss gave me $50 for that. It's the first money I ever made with my brains."

Pride of accomplishment. Loyalty because of a square deal. Anxious to help again, even if there were no money reward. Interest in the work for its own sake. Does it pay both sides?

* * * * * *

"I never had a chance."

Better say; "I never knew how to take advantage of my chances."

One man thinks it worth while pointing out the way to those who do not know. He was standing on an electric car next to a foundry apprentice.

"What do you do evenings?"

"Oh, I loaf around the streets until bedtime and then go to bed."

'Do you ever read anything?"

"No. It's pretty hard work."

"Better try. It's hard at first, but it comes easier, and the more you do it the better you'll like it. Don't take anything hard at first. Take a good story, Then when you come to like that, get some good technical book or paper about the foundry. You'll like it if you do."

Two weeks later. The same scene, the same people talking.

"Well! Done any reading?"

"Yes, I read half an hour every night, and it's getting easier."

"Fine, keep it up and make something of yourself."

Six months later. The same, but in the boss' office.

"Can you tell me something to read about my work?"

Is that boy the boss' friend? Is he worth anything more to the company than he was when he was loafing around the streets until bedtime? Was the talk worth while.

* * * * * *

He is a plain every day man. But he knows himself and he knows human nature. He knows that the average man loves and has a pride in what he initiates, and that if he can be directed to initiate properly, things are safe. So he arouses such a pride in the workman that he tries to imitate, and having once initiated he is bound to make a success of the thing proposed. He may work his men, but he works them of their own volition. He makes them believe in him, trust him and know that his word is good. He stands between them and outsiders, and above all gives them credit for every effort which they make and everything which they accomplish. It is not much. Merely the turning of attention to things proper and things desired, with the result that for loyalty to himself and his employers, for pride in their work, and a desire for self improvement, there are few who can show better results.

By the way, would the efficiency men consider this efficient?

The *Revue Générale des Chemins de Fer*, in an article on The Railways of Brazil, tells how the government of Brazil builds lines in accordance with public demand, and then leases them out either to the construction company or to some other concern to be operated. A great deal of difficulty arises when the operating company and the construction company are not the same, for in such cases the construction company exercises such stringent economy in its work that the operating company is greatly handicapped. Even the government, which pays for the work, is sometimes persuaded not to demand certain work which is really necessary. To this is due the large number of excessively sharp curves, the bad spacing of ties, the extremely light rails, etc., faults which are dearly paid for by the operating company in fuel or in abnormal maintenance of way expenses.

TESTING IRON AND STEEL FOR AIR AND SAND HOLES.

BY ETHAN I. DODDS.*

The object of the device shown in the accompanying illustrations is to locate air or sand holes in castings or forgings and in this way determine whether the material is fit for use. The arrangement consists of an electro-magnet, which slides over the work, allowing the lines of force from its poles to permeate through the metal. If these lines of force come in contact with a blow hole or sand hole the resistance is increased and will affect the current applied to the electro-magnet. This in turn will affect the intensifier or vibrator located in a sounding box. The sounding box is connected through ordinary telephone transmitters to the ear of the operator, who can in this way locate the flaws in the metal. The electro-magnets take their current from transformers, which are connected to alternating-current generators. As shown in Fig. 1, two electro magnets are used and they are mechanically connected; this gives better results where it is possible to use them in this way.

In developing this apparatus other devices were used, such as galvanometers and other sensitive electrical measuring instruments, but they were found to be so affected by the vibrations, caused by heavy moving masses that they were more or less impractical. With the present arrangement the imperfections can easily be located, and after a certain amount of experience the size of the holes can in a measure be estimated, the difference in the intensity of the sound being the measure of the size of the flaw. Figs. 2 to 7 illustrate how other types of electro-magnets are used for testing different parts.

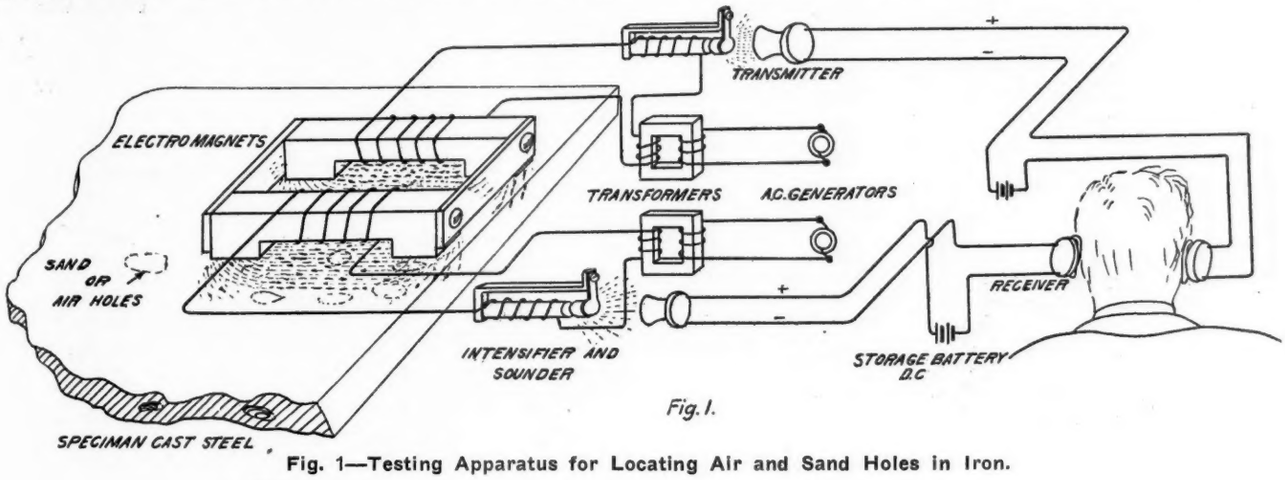
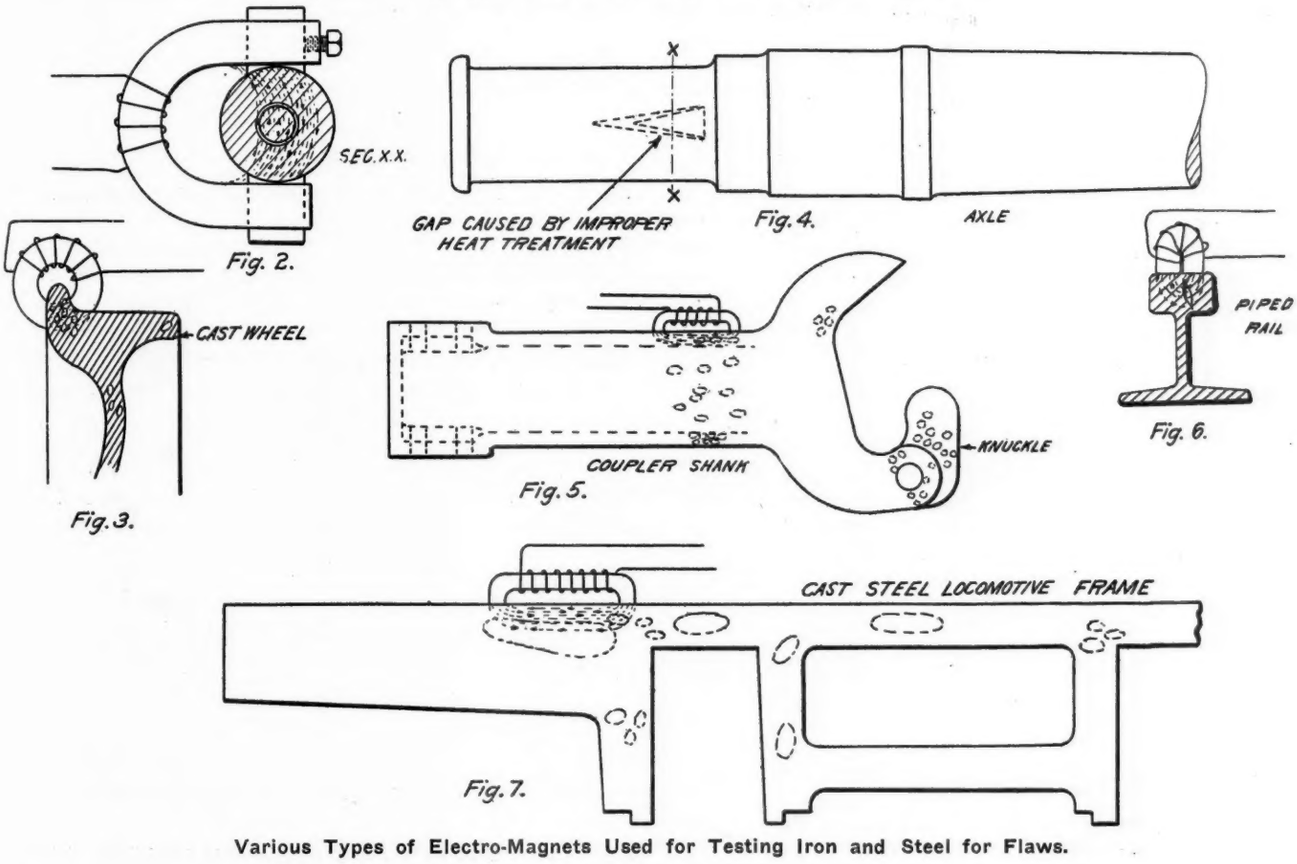


Fig. 1—Testing Apparatus for Locating Air and Sand Holes in Iron.



Various Types of Electro-Magnets Used for Testing Iron and Steel for Flaws.

*Mr. Dodd was with the Westinghouse Electric Company for a number of years, was mechanical engineer and chief engineer of the Pullman Company for three years, and assistant mechanical superintendent of the Erie for three years. The apparatus he suggests was the result of an extensive and expensive series of experiments extending over a long period. He says: "I have struggled along for several years with this at an enormous expense till I can hardly proceed further. Possibly some of your readers having a greater knowledge of physics and better fitted for research work of this class, and having more money to develop these ideas, can complete the work. I am not seeking pecuniary returns. If we could save a single life by the installation of this system I would be satisfied."

WHEEL AND AXLE SHOP KINKS.*

BY C. C. LEECH,
Foreman, Pennsylvania Railroad, Buffalo, N. Y.

DISMOUNTING WHEELS AND AXLES.

The arrangement of the wheel and axle shop is shown in Fig. 1. The system of overhead hoists and runways is such that the axles may easily be handled from one part of the shop to the other in the processes of dismounting, storing, finishing

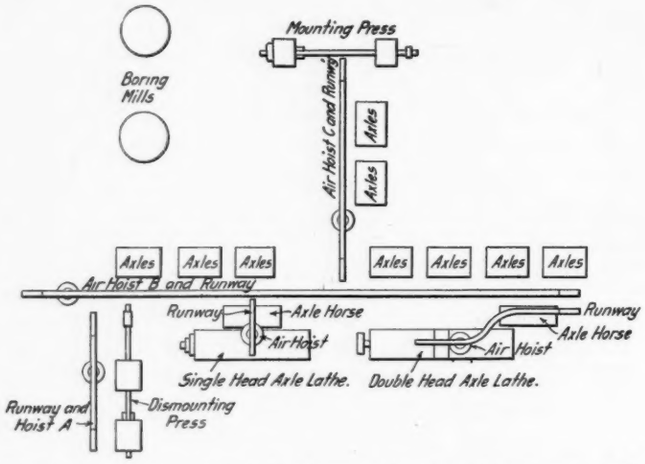


Fig. 1—Arrangement of Equipment in the Wheel and Axle Shop.

or mounting. The storage space is indicated by the locations marked "axles."

The press for dismounting the car wheels is shown in Fig. 2. One of the wheels has been pressed off and the end of the axle is supported by the hook *A*. This hook is suspended from the crane *C*, which swings around the pivot at its left hand end. The hand wheel *W* is used for adjusting the hook to the proper height. When the operator, who is engaged in rolling the wheel

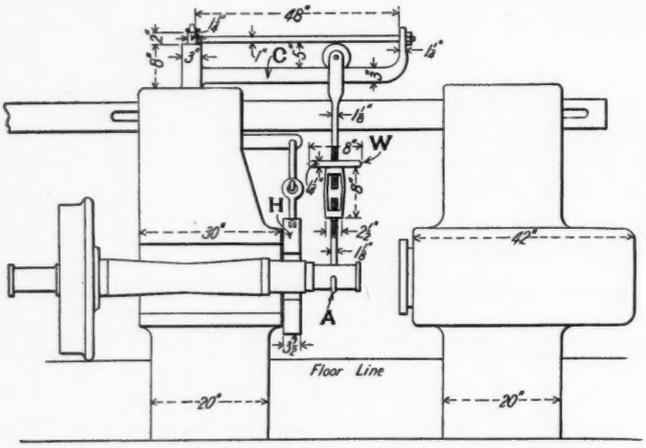


Fig. 2—Press for Dismounting Car Wheels and Axles.

away, returns, he grasps the hook *A* and pulls it away from the machine; at the same time the second operator rolls the mounted wheel in such a direction that as the crane *C* swings outward and around, the wheel will slip into proper position in the press. As the crane swings around the first operator follows it, passing in front of the press and out of the way of the opposite end of the axle and the wheel which is being pushed into position. The wheel press is provided with three large U-shaped blocks, *H*, of iron, which have openings large enough to slip over the axle between the wheel press carriage and the hub of the wheel, as shown in Fig. 2. The three sizes of U-blocks will take care of all of the different size axles which it is necessary to handle on the press. In the average axle shop it is not always feasible to group the different size axles together when pressing off the wheels, and this necessitates the frequent changing of the U-blocks. As they weigh from 200 to 500 lbs. apiece it is, of course, impractical to change them by hand. To overcome this difficulty a system of swinging cranes was devised, as shown in the end elevation of the wheel press, Fig. 3. The U-piece *H* is suspended from the crane *G* in such a way that when the crane swings forward the U will slip over the

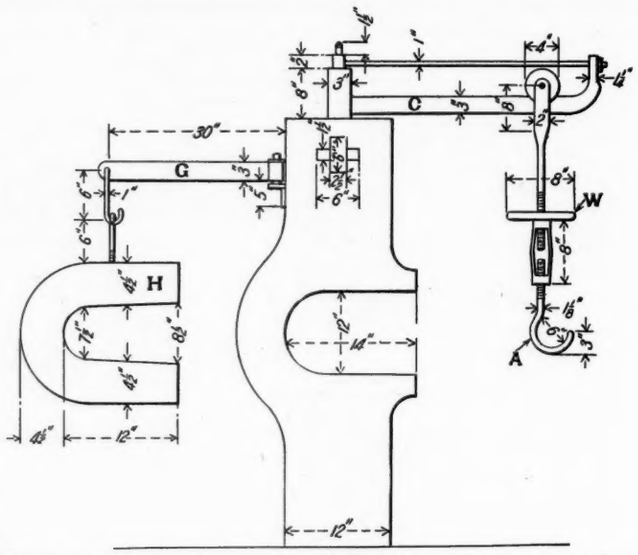


Fig. 3—End View of Press for Dismounting Wheels and Axles.

axle, as shown in Fig. 2. By having a crane for each U-piece, each with a different radius, and swung from different levels, it is possible to provide for three of the U-pieces and to quickly replace one by another as occasion demands.

ADJUSTING CAR AXLES IN LATHE.

After swinging an axle into a lathe, preparatory to turning, the operator enters one end on one of the lathe centers. It then becomes necessary to raise the other end slightly in order that the center may enter it properly. To do this the block or fulcrum *A*, which is shown in Fig. 4, is placed on the tool block of the lathe, the curved portion of the lever resting underneath

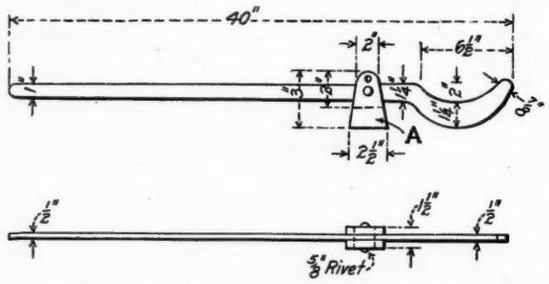


Fig. 4—Device to Adjust End of Car Axle to Height of Lathe Centre.

the journal of the axle. By pressing down on the end of the lever the axle may easily and quickly be raised to the required height.

AXLE HOISTS.

When both wheels have been pressed off, the axle is placed in the hook *F* of the air hoist *A*, Fig. 5, which operates on an overhead trolley, as indicated in Fig. 1. It is pushed about 12 ft.

*These kinks were included as a part of the collection which Mr. Leech submitted in the shop kink competition that closed May 15. Combined they cover the work of the wheel and axle shop so well that it was thought advisable to form them into a separate collection.

beyond the press, and is delivered to the hoist *B*, which operates on a runway about 45 ft. long and at right angles to *A*. The axle and turning lathes and the spaces for the storage of axles, are placed parallel to the runway, axle horses being provided in front of each of the lathes. With this arrangement the

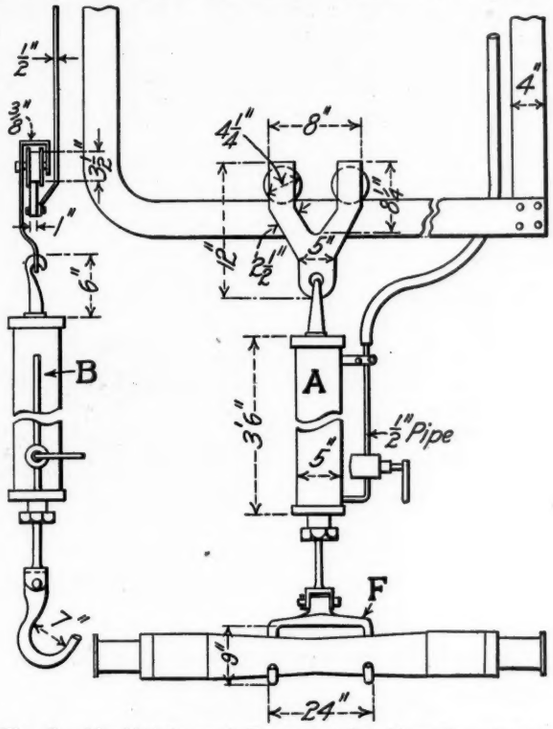


Fig. 5—Air Hoists and Runways for Handling Axles.

axles may quickly be handled to any desired point, and the workmen very soon become experts in handling them successfully and rapidly.

In handling the axles into a double head lathe where the drive is in the center, it is necessary to provide a special bracket or collar, as shown in Fig. 6, allowing them to be swung from one end. The operator quickly gets on to the knack of placing

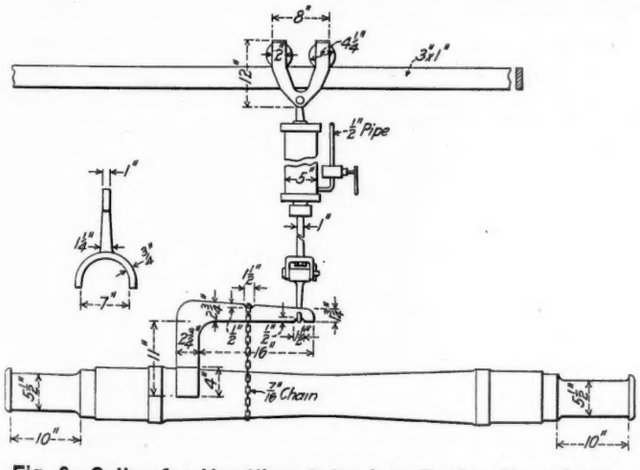


Fig. 6—Collar for Handling Axles into Double Head Lathe.

the bracket and chaining it in such a position that the axle will balance horizontally when it is hoisted from the floor. The hoist is arranged so that it raises the axle to the exact height of the lathe centers and holds it there while the centers are being adjusted.

The apparatus shown in Fig. 7 has been devised for the convenient placing of axles in a single head lathe. The various parts are forged from wrought iron or soft steel. The part *A* turns freely on the end of the air hoist piston rod. The part *B* has a flexible connection to *A* through the ¾-in. pin. The screw *C* fits in *B* and has a crosshead at its upper end which works freely on the end of the screw, sliding up and down in the slotted part of *B* when it is necessary to adjust the screw. The crosshead has a gage line on it, and the sides of *B* are graduated as shown, these graduations being used for a purpose which will be considered later. At the lower end of the screw is the double hook in which the axle rests as it is lifted from the floor into the lathe. The air hoist is hung at a height to accommodate the largest diameter axle. If an axle of any other diameter is handled the screw must be adjusted to bring the hook to the proper height. The graduations on *B* are carefully made to accommodate the different size axles and in changing from one size to another it is only necessary for the operator to adjust the screw until the line on the crosshead is in line

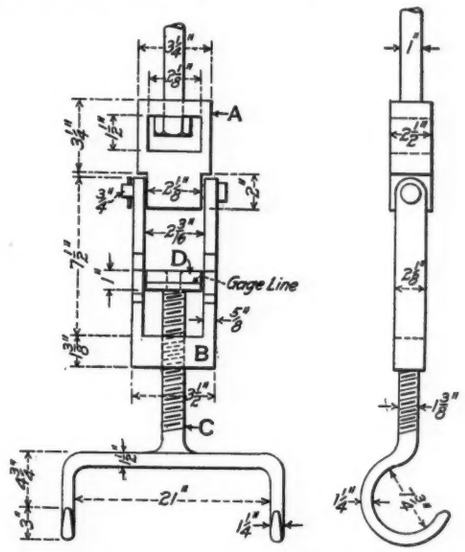


Fig. 7—Air Hoist Attachment for the Convenient Handling of Axles Into an Axle Lathe.

with the proper graduation on *B*. In this way the time is saved of going to the end of the lathe two or three times to see if the axle is at the proper height to fit the lathe centers.

PILING AXLES.

The device shown in Fig. 8 is constructed of 1½-in. piping, ells and tees, and is convenient for piling axles in the wheel shop. After the first lot of axles have been placed on the floor the ends *A* of the device are placed on the first or nearest axle, the legs of the horse resting on the floor and within reach of the air hoist. The remaining axles are lowered on the horse by the air hoist and are allowed to roll on the pile. The length

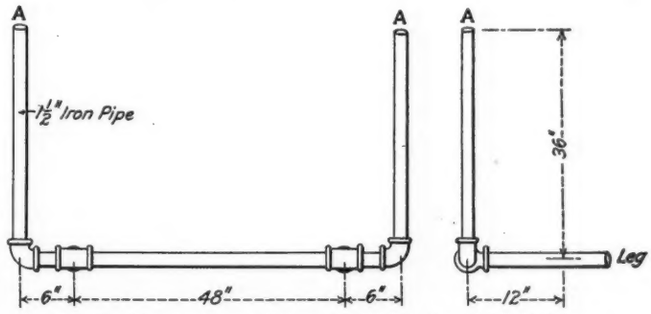


Fig. 8—Device for Piling Axles in the Wheel Shop.

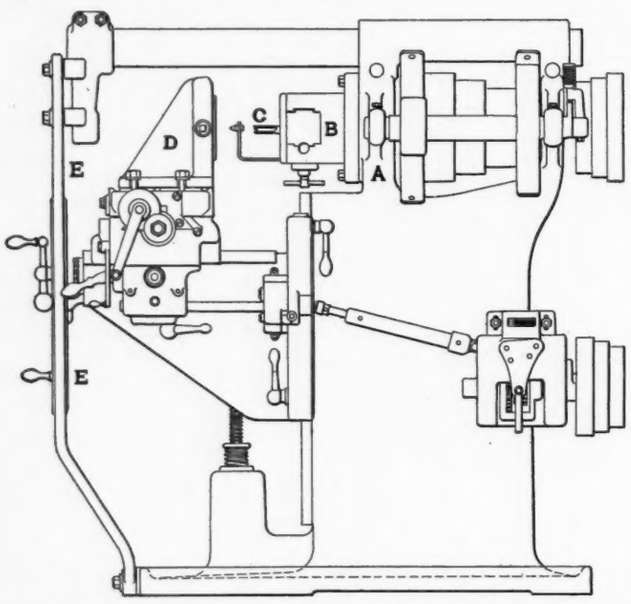
of the legs may be made such that one of the horses can be used for piling two rows of axles. The use of the device allows the axles to be piled on either side of and at right angles to the runway which carries the crane or hoist. In this way a number of piles may be placed within reach of the air hoist.

BORING SQUARE HOLES.

Attachments for drilling square holes have been made for lathes, milling machines and drills, but on account of the peculiar forces attendant in drilling square holes, these devices have not proved very satisfactory. They cannot be fastened rigidly enough to withstand the side thrust, caused by the eccentric jarring motion of the cutter, at right angles to the working spindle. The carriage of the average lathe does not offer sufficient stiffness to hold the working pieces rigidly in position, which is necessary to obtain perfectly square holes. Apparently this work can only be done satisfactorily with a special machine tool, in which the arrangements for cutting square holes are embodied in the design.

The R. K. LeBlond Machine Tool Company has designed a combination machine tool for the Niles-Bement-Pond Company, New York, which is not only adapted for milling square holes, but also possesses all the features of a standard milling machine. The principle used is the same as employed in other similar devices, namely, the revolution of a triangular shaped bit, similar to an end mill, in a stationary master guide, which in appearance is much like a regular drill chuck. This stationary guiding chuck is entirely different from all previous devices, being fastened directly to the column of the machine by means of a flange, which eliminates all lost motion.

The cutter *C* receives its motion from a special driving member which is fastened to the nose of the spindle. This driving member not only causes the cutter to rotate, but at the same time gives it freedom to travel eccentrically in the master guide. The whole arrangement for cutting square holes, simple in itself, is easily detached in a very short time, leaving the machine available for regular milling work. When cutting square holes in tough material it is best to first drill a round hole. For this

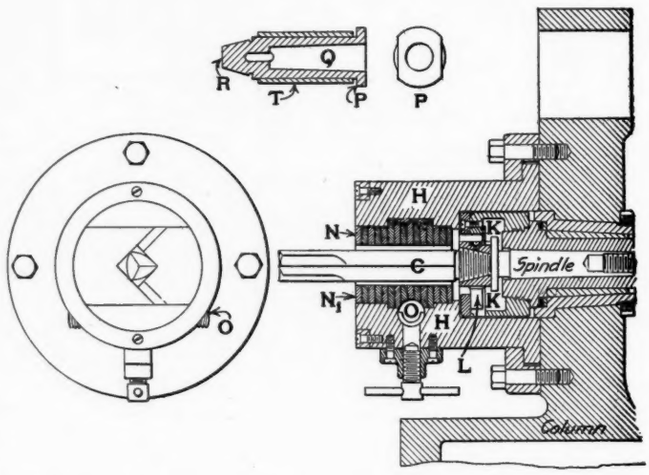


Milling Machine Designed for Boring Square Holes.

reason the machine is furnished with an appliance for operating ordinary twist drills which engages in the arrangement for boring square holes. Both operations may be done on the same piece in succession.

As the attachment for cutting square holes projects considerably beyond the nose of the spindle, it would, on a standard machine, decrease the working space in front of the cutter. Therefore, the column bearing the main spindle has been set back to gain the distance taken up by this projection, thus maintaining the full working range of the table. A special brace *E* is provided connecting the knee with the overhanging arm, as well as with the base of the machine, so as to secure absolute rigidity of the work on the table. The machine is arranged with two separate cross-feeds, one for the regular milling work, and the other for extra fine feeds, starting from .001 in., for the cutting of square holes requires a very fine feed. The work must be held absolutely rigid, and a special vise *D* is furnished with the machine for this purpose.

The accompanying illustrations show a side view and a partial horizontal cross-section through the square hole cutting attachment. *A* is the column of the machine, and *B* is the detachable



Cross-Section Through Square Hole Cutting Arrangement.

chuck which holds the square hole cutter *C*. The square hole attachment, shown in the cross section, consists of the driving member *K*, which is screwed to the nose of the spindle, and the stationary chuck *H*, which is bolted to the column. The driving member contains a floating driving dog *L*, into which the cutter *C* is screwed. Behind this dog is a floating thrust plate which takes up the end thrust of the drills. The stationary guiding chuck contains the master guide, which consists of two jaws *N* and N_1, forming an adjustable square guiding hole in which the drill *C* operates. *O* is a right and left hand screw of opening and closing the jaws in accordance with the size of the drill used.

For boring round holes in connection with the attachment for cutting square holes, a round bushing, having a regular Morse taper, is inserted in the square guiding hole, which serves as a bearing for the shank. The machine is furnished with a complete equipment for regular plain milling. The range for boring square holes is from ¼ in. to 2 in.

FOREIGN RAILWAY NOTES.

The East Indian Railway will open two new schools for the children of its native staff stationed at Asanol and Dinapore. This company has already provided 69 schools for the exclusive education of the native children, besides 23 well-kept institutions for the children of its European employees.

The authorities of the East Indian Railway find themselves in some difficulty in providing special train accommodation for the large influx of American tourists. It appears that the railway company has been requested to arrange for several special trains during the end of November and throughout December. If the visit of two ship loads of passengers had come at another period, the railway would not have had any difficulty in coping with the situation, but the arrival of one batch of tourists coincides with that of the King and Queen of England. The enormous passenger traffic which the East Indian Railway will be called upon to cope with during the next three months will exhaust all of its resources.

General News Section.

The Philadelphia & Reading has increased the pay of telegraphers and signal men, the increases ranging from $2.50 to $5.00 a month.

The government has begun suit in New Jersey against the Erie Railroad to recover penalties of $5,000 for violation of the hours-of-service law, the charge being that enginemen have been required to work longer than sixteen hours at a time.

The mail car in train No. 55 of the Atlantic Coast Line was robbed near Columbia, S. C., on the night of November 24, the robber holding up two mail clerks at the point of a pistol. After taking the registered letters, the robber pulled the bell cord, stopped the train, and escaped.

The boilermakers (and helpers) of the American Locomotive Company at Schenectady, N. Y., who have been on strike for nearly a month, returned to work in large numbers on the morning of November 23. Neither the company nor the men have given any details of the settlement.

In the federal court at Savannah, Ga., last week, the Grand Jury returned indictments against fifteen residents of Vidalia on a charge of obstructing the United States mails. The indictments were based on occurrences connected with the strike of firemen on the Georgia & Florida Railroad about two months since.

The Delaware, Lackawanna & Western and the Baltimore & Ohio have followed the example of the Chicago & North Western in establishing "committees of safety," and enthusiastic meetings were held last week on both of these roads. On the Baltimore & Ohio the membership of the divisional committees will be changed every six months; this with a view to keeping the interest of all concerned stimulated.

Because of the alarming rate at which the loss and damage expense of the Chicago & Alton and the Toledo, St. Louis & Western is growing, the management of these lines has created the position of supervisor of stations, with the object of securing the co-operation of station, yard, train and all other employees having to do with the handling of freight in devising ways and means of reducing the operations of the road to a more scientific basis. The management believes that the solution of the problem rests largely with its employees, and that the success of efforts to reduce these expenses will largely depend on the personal interest shown in these efforts by all concerned. F. E. T. Pearne, whose appointment to the new position is announced elsewhere in this issue, will report to the superintendents in charge of their respective divisions such matters as his observation may warrant. He will send copies of his reports to the freight claim agent when they relate to the handling of freight.

Texas & Pacific's Reasons.

According to a press despatch from New Orleans, Vice-President T. J. Freeman, of the Texas & Pacific, denies that his road has vitiated any traffic contract with the St. Louis & San Francisco. He says: "A tentative proposition was submitted to the directors of the Texas & Pacific and they voted it down unanimously. No agreement was ever made by the Texas & Pacific permitting the 'Frisco to use its rails into New Orleans. The 'Frisco wanted us practically to turn our road over to them. We were to give them all the local rights enjoyed by our line at all local points. Further, the 'Frisco wanted to pay only a small portion of the maintenance costs of the line when, to all intents and purposes, the larger part of the business to move over the line would be 'Frisco's. The total expenditure for improvements called for would have amounted to about $2,000,000."

Not on the Railways.

Eighty-nine persons have been killed and several hundred injured in automobile accidents in the streets of New York since January 1, and Colonel Edward S. Cornell, secretary of the National Highways Protective Society, who has studied the records, says that "joy riding, drunken chauffeurs, ignorant owners of cars and irresponsible and reckless 'night hawk' cabmen are responsible. The 'joy riders' and the 'night hawk' cabmen are the most dangerous factors to life and limb in the city. In thirteen cases during the month of October the operators of motor cars causing serious accidents fled, thus violating the law in another way."

A New Kind of Slumber.

"Ethereal asphyxia or aerial somnipathy," was what was the matter with C. P. Rodgers, the aviator, when he fell near Compton, Cal., at the close of his transcontinental flight. Rodgers asserts that this is what caused the deaths of many other aviators. It lurks in the pockets of the upper air strata and creeps irresistibly upon the senses of an aviator, lulling him into dreamy unconsciousness. Rodgers was at an altitude of a thousand feet, he says, when he felt a sleepy sensation creeping over him and realized his peril. When about a hundred feet from the ground he went to sleep. The air had a peculiar odor, like chloroform or ether. In proof that it was not the rarefied air or weak heart he points to the fact that he lost consciousness only a hundred feet up.

The foregoing may or may not be a contribution to scientific knowledge; we cannot decide. The new terms, however, will be of interest to railway superintendents' clerks who have to record the cases of locomotive enginemen who lose control of their machines, as did Rodgers, but who can give no explanation of the trouble. It is painful to have to record that the engineman lied, as so often seems necessary. "Somnipathy" may sound better.

Rock Island Shopmen.

The threatened strike of the shop employees of the Rock Island lines has been averted by the acceptance of the proposition made by the company to the International officers of the unions on October 10. This proposition was at first rejected, but after reconsideration it was accepted on Monday of this week. The letter of acceptance, signed by the International presidents gives as the reason for accepting the terms offered the great losses and hardships which would have been imposed on the company, the employees and the public in the case of such a strike. The demands made by the men and the action taken by the company on each were printed in the *Railway Age Gazette* November 24, page 1069. The new schedule now agreed on is the same as the one in effect before the negotiations were started, both as to working conditions and rates of pay, except that employees in the service of the company traveling on the road will be allowed $1.50 a day expenses instead of $1.25. It is emphatically denied by the company that the federation of shop employees has been recognized at any time during the negotiations. A settlement has been made with each individual craft, the schedules being drawn up with separate termination clauses, and being signed by representatives of each craft and the railway officers. These individual schedules are the only ones that contain the rates of wages and exclusive service conditions. Any grievance existing on the part of a craft will be negotiated by the committee of that craft, the general committee coming into conference only when desired by the local craft. No strike can be called except by a conference of the crafts.

Railway Disaster in France.

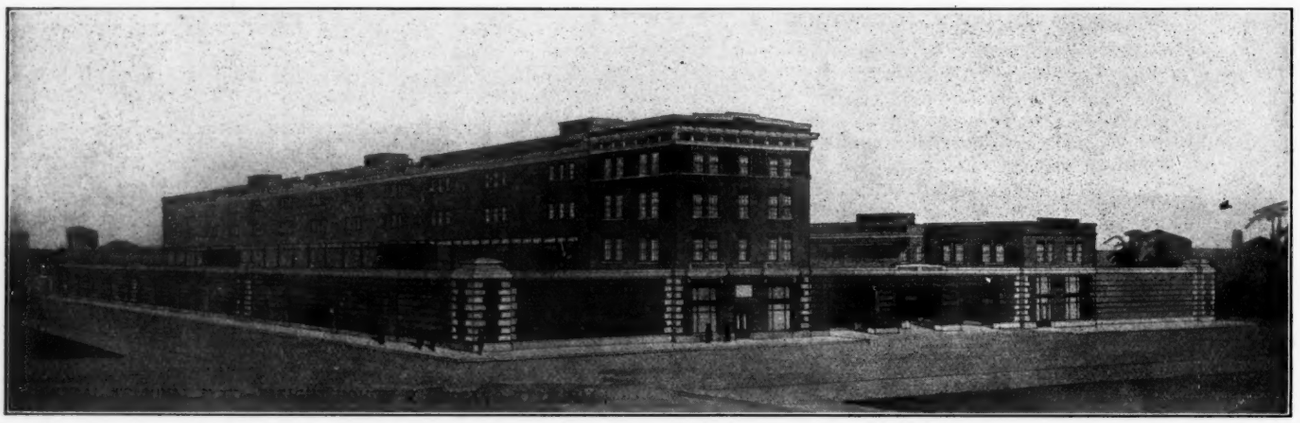
A press despatch from Saumur, France, November 23, reports the destruction on the morning of that day of a passenger train on the state railway by the failure of a bridge at Montreuil-Bellay, caused apparently by a flood in the Thouet river. Thirty or more persons were drowned, and survivors who succeeded in climbing through the windows of the cars and clinging to the roofs were compelled to remain in that position throughout the day, while hundreds of persons on the shore of the river were unable to asisst them. At night, however, military engineers reached the place with pontoons and succeeded in taking off eleven persons. The engineman of the train saved himself by catching hold of a pig, being carried along by the flood, the

animal towing him to the shore. The flood had done considerable damage previous to the bridge disaster, and all the boats in the locality had been carried off. A man who rowed out from the shore in an effort to save a child who was on the train was himself drowned.

New "Soo Line" Freight House in Chicago.

The Minneapolis, St. Paul & Sault Ste. Marie has announced its plans for an independent freight terminal in Chicago, the execution of which plans is subject to the granting by the city council of permission to cross the necessary streets and alleys and for the vacation of portions of two streets. The terminal is to be built by the Central Terminal Railway, an Illinois corporation, and leased to the Soo. The tracks of the Baltimore & Ohio Chicago Terminal Railroad will be used from Forest Park, where connection is made with the main line of the Soo, to Halsted and Fifteenth streets, from which point two new tracks will be built by the Central Terminal to a 14-track elevated freight terminal extending from Fourteenth Place to Twelfth street, between Canal and Clinton streets. Passenger trains will use the Illinois Central terminal as at present, although it is planned ultimately to use the Baltimore & Ohio station at Harrison street and Fifth avenue.

Outbound and inbound freight houses, each 500 ft. x 80 ft. in area, will extend from Twelfth to Thirteenth street. They will be of an attractive style of architecture and will be equipped with modern freight handling apparatus, including three elevators in the inbound freight house and a hoist capable of handling a freight car between the ground and elevated levels. The inbound freight house will be four stories high, and the outbound freight house two stories. Between these houses there will be three driveways, the middle drive being on an incline to the elevated track level. South of Thirteenth street there will be a 12-track team yard extending to Fourteenth street, with an inclined driveway reaching from the street to the track level. The entire layout will be elevated above the streets, starting from the present completed elevation of the Baltimore & Ohio Chicago Terminal near Halsted street. The elevation will be supported on a reinforced concrete structure similar to the viaducts already built in the city. This development will be an important addition to the railway facilities west of the river, being but a short distance south of the proposed site of the new union station and Pennsylvania freight houses.



Proposed Soo Line Freight Terminal in Chicago.

Real Life in the Train Despatcher's Office.

The following sketch is taken from an address by J. W. James, train despatcher of the Buffalo, Rochester & Pittsburgh, which was delivered before the last annual meeting of the Train Despatchers' Association. Mr. James made an earnest plea for the exercise of honesty, intelligence and devotion to duty, telling his hearers that there will be no doubt about recognition of their efforts by their superior officers if only they will put into their work the enthusiasm of which they are capable. He also called attention to the value of employees' magazines, such as are published by the Erie, the Illinois Central and other roads; and reminded the members of the association of the good use to which these periodicals could be put, to promote efficiency and loyalty. The incident quoted below bears unmistakable evidence of genuineness; but it is to be hoped that cases of the kind are not common.

It's 3:59½ p. m. Here comes Jones our second despatcher. "Hello, kid, how they coming?" is his salute to the first trick man, who is an old man. Turning aside to a young conductor in the hall, he says, "How do, old scout?" Goes to work 4:02 p. m. While looking over his transfer, he turns his head to the window, notices a lady passing. "Gee! look at that blonde," he says to the elder gentlemen in waiting (Voice on wire, "82 here." "Minute; making transfer.") Turning to the first trick man again, he says: "That blonde reminds me of a coincidence today—I met a swell looker at the show." (Voice on wire, "Local is ready." "Hold them minute, I'm making transfer.") "She put her lamps on me and it was all off with your uncle Bill." (Voice on wire, "Can you give No. 80 five minutes on 95?" "No, tell him he lost five minutes asking for it.") "That's Murphy," says Jones, "he is one of those guys that always lacks five minutes. And so we took in all the moving picture shows in town." (Voice on wire, "76 coming. Will I kill this dead one and let 'em go?" "Yes, hang her on the nail, kid, and I'll give you a number later.") "Lot of nice people spoke to her, too, but she wouldn't tell me what her name was." (Voice on wire, "Can you take a rush message?" "No, give it to the brass pounder. It's about having inspector on hand to rebrass old man's car. I'll tell the kid with a large forehead to answer you.") "She handed me a line of talk about always wanting to know a real, true blue, railway man. One that was high up."

Later on in the evening a few trainmen entered, all enjoying a hearty laugh over some joke. "Do we bother you, Jonesey, old boy?" inquired one of them as he was leaning over the sheet. "No, go as far as you like," was the reply. "Say, Jones, I want to ask you a question—If I get to C and find only two loads to pick up and have time to make D for 82, wouldn't you pass them up and save all that delay?" All of them were listening for Jones' reply to Ryan's question. "Sure thing; tell operator to lay low and hand them to some following train. I can fix it on the sheet."

Operator on the line hears the racket in despatcher's office and jokingly inquires what it is. Jones says, "Why, that's Ryan making a rough house." The operator in turn gives this information to the conductor of a train who is at his station. As they pull out, this is the conversation in that caboose: "That Jones is a fine fellow—well, the whole bunch are on the square. Jones never turned in a fellow since he's been there." Flagman gets in his, "Well, Smith isn't very handy with his pencil either." Finally they come to the winning qualities of the third trick man, Brown. Head brakeman says, "Brown's the boy, he don't care and they know it; but he's got the ability and can stick as long as he likes." "Yes," replied the conductor, "and he is wiser than they think he is—we were out the other night and Brown and I unloaded a few. He was feeling pretty good and put me wise to a few things. Don't mention, however, what I said about his

taking on a couple; he wasn't piped to the gills, just had a comfortable skate when he went to work." A few days passed and Jim Barrett comes in to see Brown about a rejected time slip. "You remember that turn I made the other night?" and Brown said he did. "Well, they only allowed me straight mileage on that. I have a good notion to hand this over to our committee." "I don't blame you one bit," says Brown. "These $40 guys," referring to timekeepers, "make me tired. They think their efforts are appreciated and they get company-struck right in the beginning." Continuing Brown says, "We are not getting what is coming to us, either, but you cannot get those guys together for the reason so many of them prefer to be fanned with an ostrich feather with the label, 'Official' on it."

Railway Educational Association.

In March of this year the post office department thought it had discovered a use of the mails for fraudulent purposes and so seized the books of the Railway Educational Association, Brooklyn, N. Y., of which George H. Baker is president. This association is a correspondence school for locomotive firemen and brakemen, and guarantees, when the course has been finished, to find work for the student or refund one-half the tuition fee. As witnesses for the prosecution, the government found 82 men, out of the thousands who had been students, who were disgruntled for some reason and who were willing to testify. In the course of the search for witnesses, many railway officers were addressed and from them the district attorney received many letters praising the work of the school and insisting on its value and reliability, even going to the extent of urging that the suit be abandoned.

On the stand, 80 of the 82 students for the prosecution testified that no misrepresentations had been made and that they had not obtained positions because they had declined those offered. Then seven master mechanics and trainmasters, summoned by the government, testified that they employed Mr. Baker's students and gave them the preference over the ordinary applicant for a position. For the defense, about 70 students testified as to the value of the course. Through it they had received immediate employment at wages of from $75 to $90 a month, and many of them were now earning from $175 to $185 as enginemen. Following these came a number of men who had known Mr. Baker for many years, all of whom testified as to the value of the course of instruction. Among these witnesses were: B. A. Worthington, receiver, Wheeling & Lake Erie; F. A. Delano, president, Wabash; J. F. Deems, until recently general superintendent of motive power, New York Central Lines; George L. Fowler, consulting engineer; E. T. White, superintendent of motive power, Baltimore & Ohio; Chas. Chambers, superintendent of motive power, Central of New Jersey, and between 20 and 30 others. Even a letter from the assistant comptroller of the Navy, testifying to the value of the work, was admitted. It is rarely that any man has been able to muster such an array of witnesses of high standing in his behalf, and probably never before to confute such a charge. The testimony of the defense throughout showed not only the high character of the instruction issued by the school, but the standing of Mr. Baker himself as a fuel expert, simply corroborating what is already well known in railway circles. It also appeared that his instructions have been adopted by some 95 roads, representing about one-third the total mileage of the country, and that more than 50,000 copies have been issued. ,After a trial lasting seven weeks the case was submitted to the jury on November 21. In this jury there was not a single railway man or a man who would be expected to know anything of steam engine or railway work, so that, while honest and earnest, it was incapable of weighing the evidence for what it was worth. The result was a disagreement, but it certainly is not probable that the case will be renewed.

Pennsylvania's Influence in the South.

It is rumored, although officially denied, that the Pennsylvania Railroad is looking toward establishing closer relations with the Atlantic Coast Line. The *Wall Street Journal* says:

The Pennsylvania sought an influence in the affairs of the New Haven and obtained a directorship, though the purchase of anything like control was out of the question. With its connecting railroad and bridge over Hell Gate completed, the New Haven-Pennsylvania affiliation will occupy the dominant position in regard to traffic between New England and the middle Atlantic states. The two will be increasingly powerful in the coastwise traffic, both by land and by water.

An interest in the Atlantic Coast Line would in many ways be a natural extension of this field. No other road, not even the Seaboard, has such a coastwise system as the Coast Line. It not only parallels the coast, connecting up such important ports as Norfolk, Wilmington, Charleston, Savannah, Brunswick and Tampa, but it owns and operates a network of feeders from the interior to the coast points and, by tracking and its control of the Louisville & Nashville, reaches the Gulf of Mexico at Pensacola and New Orleans, shipping centers that are expected to feel the impetus of the Panama canal opening.

Through Michael Jenkins, of Baltimore, one of its directors, the Coast Line enjoys a warm commercial friendship with the Merchants' & Miners' Transportation Co., which operates a fleet of twenty-five or thirty steamers in the coastwise trade between Boston and Jacksonville. New Haven, by the way, owns the half of this steamship company's stock not owned by Mr. Jenkins and his associates. If the opening of the Panama canal is to develop the business of the southeastern seaboard as much as most people suppose, it is apparent that the Pennsylvania, with its own lines deeply rooted in the manufacturing and coal mining center of the country, would be advantaged by extending the sphere of its influence directly southward, by land and water.

Pennsylvania itself has no points of contact with the Coast Line, but they connect by means of the union line between Washington and Richmond. Furthermore, the Louisville & Nashville, which the Coast Line controls, touches the Pennsylvania lines at Cincinnati, Louisville and St. Louis. The Norfolk & Western, which the Pennsylvania controls, touches the Coast Line at Norfolk, Richmond and Roanoke, from the latter of which places the joint line of the Norfolk & Western and the Coast Line extends to Winston-Salem.

Big Four, a Vanderbilt road, has recently made a traffic agreement with the Louisville & Nashville, establishing thereby a direct route from Chicago and the middle states to the gulf. It is difficult to believe that the Pennsylvania can look on with equanimity while other trunk line systems take such steps to guard themselves against possible unfavorable effects from the opening of the canal.

None of these considerations prove that Pennsylvania has any intention of buying into Coast Line, but all of them bear on the growing importance of the southern through lines in relation to the other transportation systems of the country.

MEETINGS AND CONVENTIONS.

The following list gives names of secretaries, dates of next or regular meetings, and places of meeting.

AIR BRAKE ASSOCIATION.—F. M. Nellis, 53 State St., Boston, Mass.

AMERICAN ASSOCIATION OF DEMURRAGE OFFICERS.—A. G. Thomason, Boston, Mass.

AMERICAN ASSOCIATION OF GENERAL PASSENGER AND TICKET AGENTS.—W. C. Hope, New York; next convention, Seattle, Wash.

AMERICAN ASSOCIATION OF FREIGHT AGENTS.—R. O. Wells, East St. Louis, Ill.; annual, June 18-21, Chicago.

AMERICAN ASSOCIATION OF RAILROAD SUPERINTENDENTS.—O. G. Fetter, Carew building, Cincinnati, Ohio; 3d Friday of March and September; annual, March 17, Chicago.

AMERICAN ELECTRIC RAILWAY ASSOCIATION.—H. C. Donecker, 29 W. 39th St., New York.

AMERICAN RAILWAY ASSOCIATION.—W. F. Allen, 75 Church St., New York.

AMERICAN RAILWAY BRIDGE AND BUILDING ASSOCIATION.—C. A. Lichty, C. & N. W., Chicago. Next annual convention, third week in October, 1912, Baltimore, Md.

AMERICAN RAILWAY ENGINEERING ASSOCIATION.—E. H. Fritch, Monadnock Block, Chicago; annual convention, March 19-21, 1912, Chicago.

AMERICAN RAILWAY MASTER MECHANICS' ASSOCIATION.—J. W. Taylor, Old Colony building, Chicago. Annual convention, June 17-19, Atlantic City, N. J.

AMERICAN RAILWAY TOOL FOREMEN'S ASSOCIATION.—M. H. Bray, N. Y., N. H. & H., New Haven, Conn.

AMERICAN SOCIETY FOR TESTING MATERIALS.—Prof. E. Marburg, University of Pennsylvania, Philadelphia, Pa.

AMERICAN SOCIETY OF CIVIL ENGINEERS.—C. W. Hunt, 220 W. 57th St., New York; 1st and 3d Wed., except June and August, New York.

AMERICAN SOCIETY OF ENGINEERING CONTRACTORS.—J. R. Wemlinger, 13 Park Row, New York; 2d Tuesday of each month, New York.

American Society of Mechanical Engineers.—Calvin W. Rice, 29 W. 39th St., New York. Annual meeting, December 5-8, New York.

Association of American Railway Accounting Officers.—C. G. Phillips, 143 Dearborn St., Chicago; annual, June 26, 1912, Quebec, Que.

Association of Railway Claim Agents.—J. R. McSherry, C. & E. I., Chicago; annual convention, May 22, 1912, Los Angeles, Cal.

Association of Railway Electrical Engineers.—Jos. A. Andreucetti, C. & N. W. Ry., Chicago.

Association of Railway Telegraph Superintendents.—P. W. Drew, 135 Adams St., Chicago; annual, June 24, 1912, New York.

Association of Transportation and Car Accounting Officers.—G. P. Conard, 75 Church St., New York; December 12-13, Louisville, Ky.

Canadian Railway Club.—James Powell, Grand Trunk Ry., Montreal, Que.; 2d Tuesday in month, except June, July and Aug., Montreal.

Canadian Society of Civil Engineers.—Clement H. McLeod, 413 Dorchester St., Montreal, Que.; Thursdays, Montreal.

Car Foremen's Association of Chicago.—Aaron Kline, 841 North 50th Court, Chicago; 2d Monday in month, Chicago.

Central Railway Club.—H. D. Vought, 95 Liberty St., New York; 2d Thurs. in Jan. and 2d Fri. in March, May, Sept., Nov., Buffalo, N. Y.

Civil Engineers' Society of St. Paul.—D. F. Jurgensen, 116 Winter St., St. Paul, Minn.; 2d Monday, except June, July and Aug., St. Paul.

Engineers' Society of Pennsylvania.—E. R. Dasher, Box 704, Harrisburg, Pa.; 1st Monday after 2d Saturday, Harrisburg, Pa.

Engineers' Society of Western Pennsylvania.—E. K. Hiles, 803 Fulton building, Pittsburgh; 1st and 3d Tuesday, Pittsburgh, Pa.

Freight Claim Association.—Warren P. Taylor, Richmond, Va.; annual, May 15, Buffalo, N. Y.

General Superintendents' Association of Chicago.—E. S. Koller, 226 W. Adams St., Chicago; Wed. preceding 3d Thurs., Chicago.

International Railway Congress.—Executive Committee, rue de Louvain, 11 Brussels; 1915, Berlin.

International Railway Fuel Association.—D. B. Sebastian, La Salle St. Station, Chicago.

International Railway General Foremen's Association.—L. H. Bryan, Brown Marx building, Birmingham, Ala.

International Railroad Master Blacksmiths' Association.—A. L. Woodworth, Lima, Ohio.

Iowa Railway Club.—W. B. Harrison, Union Station, Des Moines, Ia.; 2d Friday in month, except July and August, Des Moines.

Master Boiler Makers' Association.—Harry D. Vought. 95 Liberty St., New York; annual convention, May 14-17, Pittsburgh, Pa.

Master Car Builders' Association.—J. W. Taylor, Old Colony building, Chicago. Annual convention, June 12-14, Atlantic City, N. J.

Master Car and Locomotive Painters' Association, of United States and Canada.—A. P. Dane, B. & M., Reading, Mass.; next annual convention, second week in September, 1912.

New England Railroad Club.—G. H. Frazier, 10 Oliver St., Boston, Mass.; 2d Tuesday in month, except June, July, Aug. and Sept., Boston.

New York Railroad Club.—H. D. Vought, 95 Liberty St., New York; 3d Friday in month, except June, July and August, New York.

Northern Railway Club.—C. L. Kennedy, C., M. & St. P., Duluth, Minn; 4th Saturday, Duluth.

Omaha Railway Club.—H. H. Maulick, Barker Block, Omaha, Neb.; second Wednesday.

Railroad Club of Kansas City.—C. Manlove, 1008 Walnut St., Kansas City, Mo.; 3d Friday in month, Kansas City.

Railway Club of Pittsburgh.—J. B. Anderson, Penna. R. R., Pittsburgh, Pa.; 4th Friday in month, except June, July and August, Pittsburgh.

Railway Industrial Association.—G. L. Stewart, St. L. S. W. Ry., St. Louis, Mo.; annual, May 12, 1912, Kansas City, Mo.

Railway Signal Association.—C. C. Rosenberg, Bethlehem, Pa.

Railway Storekeepers' Association.—J. P. Murphy, Box C, Collinwood, Ohio.

Richmond Railroad Club.—F. O. Robinson, Richmond, Va.; 2d Monday, except June, July and August.

Roadmasters' and Maintenance of Way Association.—L. C. Ryan, C. & N. W., Sterling; September, 1912, Buffalo, N. Y.

St. Louis Railway Club.—B. W. Frauenthal, Union Station, St. Louis, Mo.; 2d Friday in month, except June, July and Aug., St. Louis.

Society of Railway Financial Officers.—C. Nyquist, La Salle St. Station, Chicago.

Southern Association of Car Service Officers.—E. W. Sandwich, A. & W. P. Ry., Montgomery, Ala.

Southern & Southwestern Railway Club.—A. J. Merrill, Grant bldg., Atlanta, Ga.; 3d Thurs., Jan., March, May, July, Sept., Nov., Atlanta.

Toledo Transportation Club.—J. G. Macomber, Woolson Spice Co., Toledo, Ohio; 1st Saturday, Toledo.

Traffic Club of Chicago.—Guy S. McCabe, La Salle Hotel, Chicago; meetings monthly, Chicago.

Traffic Club of New York.—C. A. Swope, 290 Broadway, New York; last Tuesday in month, except June, July and August, New York.

Traffic Club of Pittsburgh.—D. L. Wells, Erie, Pittsburgh, Pa.; meetings monthly, Pittsburgh.

Train Despatchers' Association of America.—J. F. Mackie, 7042 Stewart Ave., Chicago; annual, June 18, 1912, Louisville, Ky.

Transportation Club of Buffalo.—J. M. Sells, Buffalo; first Saturday after first Wednesday.

Transportation Club of Detroit.—W. R. Hurley, L. S. & M. S., Detroit, Mich.; meetings monthly.

Traveling Engineers' Association.—W. O. Thompson, N. Y. C. & H. R., East Buffalo, N. Y.; August, 1912.

Western Canada Railway Club.—W. H. Rosevear, P. O. Box 1707, Winnipeg, Man.; 2d Monday, except June, July and August, Winnipeg.

Western Railway Club.—J. W. Taylor, Old Colony building, Chicago; 3d Tuesday of each month, except June, July and August.

Western Society of Engineers.—J. H. Warder, 1735 Monadnock Block, Chicago; 1st Wednesday in month except July and August, Chicago.

Wood Preservers' Association.—F. J. Angier, B. & O., Baltimore, Md.; annual, January 16-18, Chicago.

Traffic News.

At the Curtis Bay pier of the Baltimore & Ohio, at Baltimore, November 23, the new collier Newton was loaded with 7,029 tons of cargo coal, and 545 tons of bunker coal in 4 hours, 35 minutes, which is said to be the world's record for speed in loading a ship.

The canal terminal amendment to the constitution of the state of New York, voted on at the last election, is said to have been adopted, though the official return of the vote has not yet been issued. This amendment provides for the establishment by the state of adequate basins, docks and buildings for the accommodation of the traffic which is expected to be carried by the enlarged Erie canal. The proposition contemplates the acquisition and improvement of property at New York, at Buffalo and at the principal cities between Buffalo and the Hudson river. In those counties not adjacent to the line of the canal there was a majority of votes against the amendment, and it is estimated that the final and complete vote will show only a small majority in favor of the terminals.

James J. Hill, chairman of the board of directors of the Great Northern, who now and then gives advice to the farmers in terse and forcible language, turned his attention at Chicago the other day for a moment to the farmers in the railway world; and he declared his belief that many of the lectures given in the trains which travel around the country are of doubtful benefit, for the reason that they do not effectively reach the persons most concerned.

The agricultural department at Washington reports that during the past year its representatives have taken part in the management of 71 instruction trains which have been run over various railways throughout the country, traveling altogether 40,000 miles. The department finds in existence 12,000 fair associations having 246,000 members. Secretary Wilson says that the farmers are so interested in this new means of instruction that the demand for lecturers is far beyond the power of the states to supply. He gives figures showing the appropriations made by different states during the past year for "institute work." Most of the states have made considerable increases over the year before.

An Unusual Manifesto.

The president of the Commuters' League of New Jersey, speaking of the proposed increase in fare by the Hudson & Manhattan is quoted in the New York papers as follows: "While the commuters of New Jersey who use the uptown tube will regret the necessity of the increase, I believe they will recognize the justice and propriety of the same. I have made a complete analysis of the situation in respect to the necessity for increased revenue and I am convinced the proposed increase in fare is entirely justified. My observation is that the commuters of New Jersey do not expect nor desire that transportation shall be furnished to them at a loss to the operating company.

"The policy of the McAdoo company and its attitude to the public has been uniformly correct. The road has been operated with due regard always to the public interest. The company has also done the right thing in stating frankly to the public at the very outset the reasons why the increase in rate is necessary."

The New York Central's Division of Rates with the Rutland.

The minority stockholders' committee of the Rutland Railroad, which has for a number of years been attempting to compel the directors to declare dividends on the cumulative preferred stock, have issued a circular to minority stockholders describing a suit which has been brought against the New York Central & Hudson River, claiming that the division of rates between the two railways had been entirely unjust to the Rutland. The suit has actually been brought and one witness for the Rutland examined but not as yet cross-examined, and it is expected that the taking of testimony alone will extend over a considerable period of time, possibly as much as six months. The circular to the minority stockholders quotes a number of rates which tend to show that when taken on a mileage basis, the division between the New York Central and the Rutland

has been very unfavorable to the Rutland. An examination of way bills, etc., was made by an accountant representing the committee, it is understood, with the permission of the New York Central, and it is pointed out by the legal department of the New York Central that the rates quoted in the circular are in many cases very misleading, since they do not show terminal charges or any charges which the New York Central was compelled to pay to other companies to which the freight was forwarded, such, for instance, as lighterage companies. Another claim of the Rutland committee is that freight has been diverted so as to give the New York Central the long haul in preference to giving it to the Rutland. This the New York Central says is so far from true that in many instances freight that would naturally move over the Central has been routed over the Rutland, through a policy of trying to develop the subsidiary property.

Traffic Club of New York.

At the meeting of the Traffic Club of New York, held at the Waldorf-Astoria, November 28, the following officers were elected for the ensuing year: President, E. G. Warfield, vice-president and general manager, Seaboard & Gulf Steamship Company, New York; vice-presidents, A. F. Mack, traffic manager, United States Steel Products Export Company, New York; W. C. Hope, general passenger agent, Central of New Jersey; F. X. Quinn, agent, Pennsylvania; W. J. Love, assistant freight traffic manager, International Mercantile Marine Company, New York; G. H. Stevenson, traffic manager, General Chemical Company, Phillipstown, N. Y.; treasurer, F. C. Earle, general traffic manager, Manhattan Navigation Company., New York; secretary, C. A. Swope, eastern freight agent, Louisville & Nashville; assistant secretary, H. L. Derby, traffic manager, Casein Manufacturing Company, New York.

INTERSTATE COMMERCE COMMISSION.

Reparation Awarded.

Southern Queen Range Co. v. Cincinnati, New Orleans & Texas Pacific et al. Opinion by the commission:

Second-class rate for loose steel sheets L. C. L. from Brackenridge, Pa., to Chattanooga, Tenn., found unreasonable and fourth-class rate found reasonable. (21 I. C. C., 608.)

E. J. Gorman v. Chesapeake & Ohio. Opinion by the commission:

Additional transportation charges paid by a passenger on account of an error of the defendant's agent should be refunded. (21 I. C. C., 613.)

Floridin Company v. Seaboard Air Line et al. Opinion by the commission:

Through the shipper's mistake, a carload shipment was consigned to Hamburg, Germany, via Savannah, Ga. The error was discovered before the car reached Savannah and instructions were given to send the car to Buffalo, N. Y., on the joint through rate from point of origin to Buffalo. The commission finds that the shipment was not similar to a through movement and that the defendant was right in charging the sum of the local rates for the movement that the car actually performed. (21 I. C. C., 610.)

Complaint Dismissed.

C. C. Foolmer & Co. v. Bellingham Bay & British Columbia Railroad et al. Opinion by the commission:

A carload shipment which was consigned via a lake steamship line arrived at the dock on November 2, and the tariff of the steamship line provides that after November 1 shipments would be subject to forwarding all rail and all rate rates if in excess of available vessel capacity. The shipment in question was forwarded all rail, which is not found to be unreasonable. (21 I. C. C., 617.)

Milling-in-Transit on Corn.

F. S. Johnson & Co. et al. v. Atchison, Topeka & Santa Fe. Opinion by the commission:

Corn millers at St. Joseph, Mo., and Kansas City can buy their corn west of these cities, mill it at these cities and ship through to the Pacific coast on the through rate from point of origin to destination, while millers at Milford, Neb., and Firth are required by the rules of the Santa Fe to buy their corn east of their mills if they are to enjoy the through milling-in-transit rate to the Pacific coast. The commission finds that this is not undue discrimination, and therefore dismisses the complaint. (21 I. C. C., 637.)

Variation of 1 per Cent. Allowed in Reweighing Coal.

Sunderland Brothers Co. v. Chicago, Burlington & Quincy et al. Opinion by the commission:

The present rule of the Chicago, Burlington & Quincy, which provides that shippers shall pay switching charges plus $1 for reweighing, and that way bill charges shall be readjusted in accordance with the actual weight, is found unreasonable, and the commission orders that the rule be made so as to provide that when the reweighing does not show a variation of 1 per cent. from the original weighing, the original charges will not be changed and reweighing charge shall be retained by the railway; but if more than 1 per cent. variation is shown, original charges shall be readjusted and reweighing charge returned to the shipper. (21 I. C. C., 632.)

Advanced Rates on Plaster Refused.

In re suspension of advanced rates on cement plaster from stations in Oklahoma to stations in Texas. Opinion by Commissioner Meyer:

The commission finds that the proposed rate of 17 cents per 100 lbs. on cement plaster from stations in Oklahoma to stations in Texas would be unjust, and that the rate from Alva and certain other stations in Oklahoma to Fort Worth, Tex., and Dallas should not exceed 13 cents C. L. minimum 40,000 lbs., and that the rate from Cement, Marlow, Chambers and McAlester, in Oklahoma, to Fort Worth, Tex., and Dallas should not exceed 10 cents. Under the long and short haul clause the defendants have filed with the commission applications affecting rates to intermediate points. These applications will be passed on later. (21 I. C. C., 591.)

Terminal Allowances at Buffalo.

Buffalo Union Furnace Co. et al v. Lake Shore & Michigan Southern et al. Opinion by Commissioner McChord:

The Buffalo Union Terminal Railroad serves the Buffalo Union Furnace Company and other industries. The complaint says that the defendants make switching allowances to terminal roads serving blast furnaces and iron industries in New York, Pennsylvania, Ohio and Illinois. It is the custom of railways, the complaint says, to perform the switching service themselves, or, where it is performed by other companies, to make an allowance for this switching service with the single exception of the Buffalo Union Terminal Railroad, which is an affiliated company with the Buffalo Union Furnace Company. The defendants claim that the circumstances are not the same with the B. U. T., and they also claim that such different treatment of different localities is not, as a matter of law, in violation of the Act to Regulate Commerce. The commission finds that there is abundant evidence that a similarity exists between the case of the Cleveland Furnace Company and the Buffalo Union Furnace Company, and that they both sell pig iron in the same market. The South Buffalo Railway does all of the internal switching for the Lackawanna Steel company and the steel company owns nearly all of its stock. It now gets $2.50 per car for this internal service. While in common law no obligation rests on the carriers to pay for the spotting of cars at any of the furnaces mentioned, yet a different question is presented if the carriers voluntarily undertake to perform this duty for some and refuse it to others. The commission believes that the present case comes under the second and third sections of the act and involves no more than that the Buffalo Union Furnace Company should be placed on equality with other furnaces. The defendants claim that the South Buffalo Railway is a common carrier serving many industries, while the Buffalo Union Terminal serves only one industry; but the commission does not find it necessary to decide whether or not either terminal railway is a common carrier, because the Cleveland Furnace Company at Cleveland serves only one industry and is closely analogous to the Buffalo Terminal, and the fact that the Cleveland company is given an allowance for switching makes the refusal to give the Buffalo company an allowance, an undue discrimination. (21 I. C. C., 620.)

REVENUES AND EXPENSES OF RAILWAYS.

MONTH OF SEPTEMBER, 1911. (SEE ALSO ISSUE OF NOVEMBER 17.)

Name of road.	Mileage operated at end of period.	Operating revenues			Operating expenses: Maintenance		Operating expenses				Net operating revenue (or deficit).	Outside operations, net.	Taxes.	Operating income (or loss).	Increase (or decr.) comp. with last year.
		Freight.	Passenger.	Total, inc. misc.	Way and structures.	Of equipment.	Traffic.	Transportation.	General.	Total.					
Ann Arbor	291	$123,779	$53,772	$188,873	$25,587	$16,736	$4,039	$59,895	$7,444	$113,701	$75,172	$1,128	$13,986	$62,314	$19,972
Atlanta & West Point	93	63,583	41,144	113,551	13,473	19,227	4,720	30,098	6,010	73,528	40,023	98	5,189	34,932	758
Atlanta, Birmingham & Atlantic	661	225,803	56,140	294,784	26,714	46,742	16,030	95,130	10,082	194,698	100,086	.....	10,500	89,586	49,144
Atlantic City	166	67,132	140,310	220,234	19,419	10,325	2,406	93,508	989	126,647	93,587	—3,009	7,000	83,578	12,141
Atlantic & St. Lawrence	166	66,849	32,890	112,237	46,610	19,167	3,930	46,758	2,808	119,273	—7,036	.....	6,658	13,694	4,749
Canadian Pacific Lines in Maine	233	51,342	19,872	77,273	18,341	12,260	4,910	31,694	3,387	70,592	6,681	.....	7,000	—319	2,266
Central of Georgia	1,915	855,442	313,575	1,284,362	133,085	228,841	38,232	374,457	37,086	811,701	472,661	5,488	47,400	430,749	141,505
Central of New Jersey	671	1,623,653	529,261	2,265,016	229,943	305,789	28,826	602,958	36,781	1,204,397	1,060,719	34,944	94,093	1,001,570	259,731
Chicago, Rock Island & Gulf	476	161,048	55,864	234,185	29,860	15,795	9,038	69,329	6,977	130,999	103,186	—187	6,512	96,487	12,301
Detroit, Grand Haven & Milwaukee	190	117,843	76,012	219,765	21,738	25,940	6,767	87,864	4,279	146,588	73,177	—88	2,880	70,209	18,125
Fort Worth & Denver City	454	284,151	144,145	449,201	30,903	63,953	7,762	126,685	13,175	242,478	206,723	—208	12,000	194,515	—8,419
Georgia Southern & Florida	395	110,874	71,710	208,651	22,540	37,689	6,195	77,233	9,149	152,806	55,845	.....	9,407	46,438	1,766
Grand Trunk Western	347	340,390	219,597	596,557	68,532	85,767	18,406	215,289	12,029	400,023	196,534	—138	31,635	164,761	32,543
Hocking Valley	351	573,858	83,250	699,027	98,962	103,842	8,905	186,633	14,944	413,286	285,741	.....	42,970	242,771	—84,718
International & Great Northern *R. R.*[1]	1,159	334,741	117,364	476,305	41,120	62,066	14,886	181,072	32,817	331,961	144,344	—69	16,500	127,775	30,730
International & Great Northern *Ry.*[1]	1,159	407,713	97,403	528,926	34,397	56,886	8,856	143,899	12,770	256,808	272,118	—69	16,500	255,549	—
Kanawha & Michigan	175	255,828	33,337	294,592	33,195	37,015	2,193	89,038	5,870	167,311	127,281	37	9,127	118,191	—30,540
Kansas City, Mexico & Orient	790	125,783	32,708	166,220	42,564	29,984	8,604	66,364	7,718	155,234	10,986	.....	6,750	4,236	—537
Louisiana Ry. & Nav. Co	350	130,254	24,415	166,303	19,403	17,077	6,318	56,587	6,206	105,591	60,712	.....	4,600	56,112	39,113
Missouri, Kansas & Texas	1,743	1,015,552	396,373	1,481,942	275,314	200,915	33,632	407,503	38,657	956,021	525,921	—730	58,626	466,565	98,505
Missouri Pacific	3,916	1,614,393	436,963	2,250,173	470,059	464,750	69,364	930,340	74,967	2,009,480	240,693	—1,935	82,600	156,158	—269,850
New Orleans, Texas & Mexico	268	73,868	18,659	98,943	25,721	11,484	4,098	43,926	6,229	91,458	7,485	.....	1,552	5,934	—3,499
Northwestern Pacific	416	155,385	183,026	362,159	50,328	40,250	3,590	112,933	9,479	216,580	145,579	.....	12,855	132,724	27,384
Philadelphia & Reading	1,014	2,952,640	644,129	3,757,237	402,908	712,751	43,419	1,177,103	64,725	2,400,906	1,356,331	19,362	90,121	1,285,572	—70,422
Pittsburg, Shawmut & Northern	240	106,329	9,549	117,989	17,345	24,386	33,398	3,647	79,715	38,274	.....	.....	1,598	36,676	10,957
Port Reading	21	98,872	—	99,572	8,310	695	33	44,594	79	53,710	45,862	—23	3,800	42,039	—32,753
St. Louis, Iron Mountain & Southern	3,314	1,803,703	529,443	2,502,809	470,685	418,770	57,061	789,549	69,429	1,805,494	697,315	—3,274	81,765	612,276	96,648
San Pedro, Los Angeles & Salt Lake	1,113	409,689	291,728	748,298	146,036	130,701	31,310	268,076	17,548	593,671	154,628	—3,147	24,700	126,781	29,345
Seaboard Air Line	3,046	1,273,957	393,492	1,837,566	275,347	277,916	55,887	617,870	56,734	1,283,754	553,812	—383	75,000	478,429	34,810
Spokane, Portland & Seattle	550	247,497	155,001	427,283	51,186	35,665	5,359	125,786	10,548	228,544	198,739	987	42,200	157,526	—158,866
Sunset	58	58,010	16,962	78,511	7,735	1,388	15	23,097	207	32,442	46,069	.....	3,389	42,680	—9,823
Trinity & Brazos Valley	462	166,073	38,873	211,208	30,247	22,030	9,248	83,203	11,598	156,326	54,882	.....	5,835	49,047	45,895
Ulster & Delaware	128	56,737	38,120	100,313	16,470	10,589	1,566	42,764	2,523	73,912	26,401	83	3,300	23,184	—9,314
Western Maryland	543	538,829	100,734	667,823	96,806	79,940	13,070	215,593	11,521	416,930	250,893	—153	21,000	229,740	—17,161
Western Pacific	934	424,608	100,747	537,690	95,587	48,721	27,851	188,518	22,087	382,764	154,926	—3,364	14,350	137,212	—
Western Ry. of Alabama	133	74,182	40,700	122,607	17,766	20,164	4,936	30,954	7,470	81,290	41,317	—263	4,612	36,442	3,792
THREE MONTHS OF FISCAL YEAR, 1912.															
Ann Arbor	291	$343,341	$180,568	$560,383	$72,958	$53,558	$13,582	$181,619	$22,148	$343,865	$216,518	$5,170	$41,956	$179,732	$57,585
Atlanta & West Point	93	160,552	128,932	315,577	37,749	57,595	14,808	89,358	15,308	215,018	100,559	435	15,567	85,427	17,146
Atlanta, Birmingham & Atlantic	661	551,357	192,374	782,606	82,235	122,715	48,075	279,924	27,300	560,249	222,357	.....	31,500	190,857	65,422
Atlantic City	166	213,101	633,985	885,638	59,758	32,147	10,645	349,370	4,616	456,536	429,102	—11,903	21,000	396,199	35,196
Atlantic & St. Lawrence	166	193,224	104,488	332,497	127,631	62,913	12,599	138,286	8,692	350,121	—17,624	.....	19,976	—37,600	—11,616
Canadian Pacific Lines in Maine	233	124,529	60,232	202,651	75,950	38,028	15,094	88,665	9,795	227,532	—24,881	.....	21,000	—45,881	42,452
Central of Georgia	1,915	2,005,547	1,039,208	3,310,269	419,590	662,295	104,956	1,064,785	107,711	2,359,337	950,932	20,888	142,200	829,620	61,461
Central of New Jersey	671[2]	4,452,980	1,721,022	6,497,137	661,441	913,492	96,175	1,841,475	114,125	3,626,708	2,870,429	198,249	282,120	2,786,558	555,426
Chicago, Rock Island & Gulf	476	457,125	167,238	674,383	101,321	47,079	29,536	219,037	23,517	420,590	253,793	—778	25,515	227,500	51,230
Detroit, Grand Haven & Milwaukee	190	332,065	219,160	625,512	72,588	76,492	21,390	254,901	12,834	438,205	187,307	—172	8,639	178,496	101,167
Fort Worth & Denver City	454	721,350	460,066	1,242,824	91,072	177,805	23,435	359,592	37,476	689,380	553,444	—1,856	36,500	515,088	24,516
Georgia Southern & Florida	395	294,180	215,490	587,420	62,861	115,430	19,663	229,918	26,891	454,763	132,657	.....	28,221	104,436	—5,248
Grand Trunk Western	347	984,959	666,923	1,765,274	239,409	257,966	59,030	642,609	39,992	1,239,006	526,268	—427	94,905	430,936	171,851
Hocking Valley	351	1,617,668	269,808	2,016,951	288,545	293,736	24,498	549,905	44,285	1,200,969	815,982	.....	126,015	689,967	—167,195
International & Great Northern *R. R.*[3]	1,159	1,184,447	518,997	1,819,898	253,595	258,308	51,052	752,751	79,061	1,394,768	425,130	—701	56,500	367,929	22,295
Kanawha & Michigan	175	781,032	98,635	895,964	106,364	133,954	6,973	250,415	19,574	517,280	378,684	—2	27,547	351,135	—19,137
Kansas City, Mexico & Orient	790[4]	302,803	99,743	426,733	116,272	101,143	25,967	199,892	22,781	466,055	—39,322	.....	20,250	—59,572	—41,549
Louisiana Ry. & Nav. Co	350	351,955	74,135	459,110	63,567	45,964	17,748	162,986	19,220	309,485	149,625	.....	13,800	135,825	72,936
Missouri, Kansas & Texas	1,743	2,821,524	1,187,493	4,274,371	807,326	657,042	101,653	1,286,035	123,728	2,975,784	1,298,587	—2,406	175,626	1,120,556	140,785
Missouri Pacific	3,916	4,706,985	1,343,338	6,664,739	1,323,638	1,479,803	194,115	2,792,024	218,343	6,007,923	656,816	—5,490	247,800	403,526	—826,707
New Orleans, Texas & Mexico	268	213,011	59,072	292,179	65,109	38,885	13,337	132,990	20,208	270,529	21,650	.....	3,104	18,546	4,777
Northwestern Pacific	416[5]	428,112	634,814	1,130,594	152,141	121,733	11,286	341,625	27,485	654,270	476,324	.....	38,424	437,900	23,093
Philadelphia & Reading	1,014	8,320,908	1,935,714	10,759,257	1,190,782	2,118,498	126,816	3,410,528	200,489	7,047,113	3,712,144	67,264	271,524	3,507,884	—197,866
Pittsburg, Shawmut & Northern	240	295,462	31,144	332,115	46,907	70,006	3,305	94,976	11,381	226,575	105,540	.....	4,777	100,763	49,059
Port Reading	21	245,754	—	252,160	27,557	884	93	84,792	437	113,763	138,397	—2,975	11,400	124,022	—34,068
St. Louis, Iron Mountain & Southern	3,314	5,173,251	1,612,774	7,285,163	1,375,102	1,294,793	163,744	2,321,989	208,370	5,363,998	1,921,165	—9,257	245,295	1,666,613	191,156
San Pedro, Los Angeles & Salt Lake	1,113	1,260,487	835,179	2,227,913	444,916	423,766	92,660	822,761	51,047	1,835,151	392,762	—9,804	74,375	308,583	24,920
Seaboard Air Line	3,046[6]	3,367,887	1,244,024	5,151,310	777,740	801,845	160,082	1,788,795	157,169	3,685,631	1,465,679	683	222,000	1,242,996	101,561
Spokane, Portland & Seattle	550[7]	688,175	540,850	1,302,887	136,035	116,091	23,748	326,519	31,593	633,986	668,901	8,880	126,600	551,181	—137,809
Sunset	58	219,977	52,264	282,610	30,472	4,027	64	66,866	897	102,326	180,284	.....	10,169	170,115	1,924
Trinity & Brazos Valley	462	341,999	117,320	478,209	81,447	76,725	30,551	214,820	30,530	434,073	44,136	.....	12,835	31,301	109,829
Ulster & Delaware	128	179,572	193,653	389,984	48,461	32,890	6,050	133,794	7,393	228,588	161,396	23	9,900	151,519	—3,510
Western Maryland	543	1,489,231	322,909	1,893,603	271,662	212,037	36,830	610,359	36,348	1,167,236	726,367	865	63,000	664,232	—111,307
Western Pacific	934	1,092,803	329,420	1,459,855	241,422	119,229	84,467	528,543	62,843	1,036,504	423,351	—9,431	43,050	370,870	—
Western Ry. of Alabama	133	182,889	122,123	329,458	57,658	64,017	15,197	89,718	19,002	245,592	83,866	—651	13,837	69,378	10,245

[1]Report of J. & G. N. *R. R.*, I. J. Freeman, Receiver, to September 15; I. & G. N. *Ry.* September 16 to 30, 1911; [2]Totals to September 15, inclusive, only; increase or decrease for combined operations. Mileage operated on September 30, 1910—[3] 631 miles; [4] 740 miles; [5] 376 miles; [6] 3,027 miles; [7] 429 miles. — Indicates Deficits, Losses and Decreases.

Class Rates from Seattle to Points in Washington and Montana Ordered Finally Reduced.

Portland Chamber of Commerce v. Oregon Railroad & Navigation et al. Transportation Bureau of Seattle et al. v. Northern Pacific et al. Opinion by Commissioner McChord:

The original order of the commission, 19 I. C. C., 265, reduced class rates by 20 per cent. from Tacoma, Wash., Seattle, and Portland, Ore., to points in Washington, Oregon, Idaho and Montana. Carriers were ordered to keep account of their losses through these reductions, and the total losses on the O. R. & N., O. S. L., G. N. and N. P. are estimated at $489,070. This includes a large sum for indirect loss, the direct loss for a year being only $126,921. Even including the large estimated indirect loss, the total loss amounts to less than 1 per cent. of the roads' net operating revenue, and the financial condition of the defendants appears to be such that the commission need not hesitate to establish the rates which it has found to be reasonable. In the present instances there seems to be no reason why the eastbound distributing rates from Portland, Seattle and Tacoma should not be constructed on a mileage basis, and an order of this nature will, the commission thinks, result in a more satisfactory adjustment than the establishment of particular rates to representative destinations. Such an order is therefore made. (21 I. C. C., 640.)

STATE COMMISSIONS.

The California State Railway Commission has ordered the reduction of the rates for berths in sleeping cars between San Francisco and Los Angeles to a uniform price, $1.25. The order is to take effect December 15. Under the existing tariff the rate for one passenger is $1.50; for two passengers $2.50; for three passengers $4, and for four passengers $4.50.

COURT NEWS.

In the United States Court at New Orleans, November 18, the American Chicle Company was indicted, by the Grand Jury, on ten counts, for violating the interstate commerce law in giving false valuations on shipments of chewing gum.

In the Federal court at Buffalo, N. Y., November 27, the Grand Jury returned indictments against the Delaware, Lackawanna & Western for violation of the law in carrying hay free of charge. It appears that the hay was the property of the railway company, or of its coal mining interests, and was intended for use in the mines.

The Supreme court of New Jersey has sustained the Public Utilities Commission of that state in requiring the railways to sell season tickets to Jersey City, Hoboken and Camden. The long standing practice of all the roads has been to sell no season tickets to these towns, thus compelling persons requiring such tickets to buy to New York or Philadelphia. In doing this they pay, nominally for ferry service, not used.

The United States Circuit Court of Appeals at New Orleans, November 23, confirmed the judgment of the lower court sustaining the railroad commission of Louisiana in its order reducing rates for the transportation of cotton seed and cotton products on the Texas & Pacific, the decision being written by Judge Newman. The commission ordered the reduction on the ground that the rates prescribed by the railway were excessive as compared with those on other railways in that state and in some instances unjust to certain localities. A master, reporting to the lower court, had decided in favor of the railway, basing his opinion partly on a valuation of the road, in which he estimated the value as equal to that of the outstanding stock and bonds. The court rejected this valuation as omitting consideration of important elements as laid down by a decision of the Supreme court of the United States. The master was also criticized for failing to allow a presumption in favor of the correctness of the commission's action. The court finds the evidence wholly insufficient to overcome this presumption.

Dining cars have recently been put in service on some of the Indian railways and are said to be rapidly becoming popular.

Railway Officers.

ELECTIONS AND APPOINTMENTS.

Executive, Financial and Legal Officers.

R. A. Brand, freight traffic manager of the Atlantic Coast Line, at Wilmington, N. C., has been elected fourth vice-president, with office at Wilmington.

A. B. Eldredge, first vice-president and general attorney of the Duluth, South Shore & Atlantic at Marquette, Mich., has been elected president, with office at Marquette, succeeding W. F. Fitch, resigned effective November 30.

H. J. Horn, assistant to president of the New York, New Haven & Hartford, will on January 1, become vice-president in charge of the operating department, Samuel Higgins, general manager, who has been on leave of absence for several months, having resigned, effective December 31.

W. G. Van Vleck, second vice-president and manager of the Galveston, Harrisburg & San Antonio and the Texas & New Orleans, has been appointed vice-president and general manager of those lines and Morgan's Louisiana & Texas Railroad & Steamship Company, the Louisiana Western, the Houston & Texas Central, the Houston East and West Texas and the Houston & Shreveport, with office at Houston, Tex. H. M. Mayo has been appointed assistant to the president of all those lines.

Operating Officers.

See an item regarding the New York, New Haven & Hartford, under Executive, Financial & Legal Officers.

L. M. Betts has been appointed car accountant of the Belt Railway Company of Chicago, with office at Auburn Park, Chicago.

W. W. Walker, general freight agent of the Duluth South Shore & Atlantic, at Duluth, Minn., has been appointed general manager.

Y. M. Martin has been appointed assistant superintendent of the Houston & Texas Central, with office at Houston, Tex., succeeding W. T. Hall, promoted.

C. H. Hubbell, general inspector of transportation of the Chicago, Rock Island & Pacific at Chicago, has been appointed superintendent of telegraph of the Rock Island Lines, with office at Chicago, succeeding J. G. Jennings, deceased.

F. B. Irvine, assistant superintendent of the Texas & New Orleans and the Galveston Harrisburg & San Antonio, at Houston, Tex., has been appointed superintendent, with office at Houston, succeeding A. S. Johnson, resigned.

C. D. Peckenbaugh, superintendent of the Sterling division of the Chicago, Burlington & Quincy at Sterling, Colo., has been appointed superintendent of the Sheridan division, with office at Sheridan, Wyo., in place of F. G. Robbins, absent on account of illness. F. R. Mullen, trainmaster at McCook, Neb., succeeds Mr. Peckenbaugh.

F. E. T. Pearne, freight claim adjuster of the Chicago & Alton and the Toledo, St. Louis & Western, has been appointed supervisor of stations, with office at Chicago, the duties of his position being to see that stations are properly operated in respect to organization, and particularly as to the proper handling of freight. See item in General News Section.

E. R. Bissell, superintendent of the Lake Erie & Western at Lafayette, Ind., has been appointed assistant superintendent of the Lake Shore & Michigan Southern, with office at Chicago, succeeding F. M. Smith, promoted. E. V. Brogan, trainmaster of the Eastern division of the Lake Shore at Erie, Pa., has been appointed assistant superintendent of that division, with office at Buffalo, N. Y., succeeding W. F. Schaff, promoted. A. E. Lloyd, assistant trainmaster of the Eastern division at Collinwood, Ohio, succeeds Mr. Brogan, and J. P. Freeman succeeds Mr. Lloyd.

The Western division of the Canadian Northern has been divided into the Central and Western divisions, and J. R. Cameron, general superintendent at Winnipeg, Man., has been appointed assistant general manager, with jurisdiction over all lines, and

office at Winnipeg. A. Wilcox, superintendent at Port Arthur, Ont., has been appointed general superintendent of the new Western division, with office at Edmonton, Alb., and A. E. Warren, superintendent at Winnipeg, has been appointed general superintendent of the Central division, with office at Winnipeg. M. B. Murphy succeeds Mr. Warren.

L. H. Phetteplace, whose appointment as general superintendent of the Carolina, Clinchfield & Ohio, in charge of operation and maintenance, with office at Erwin, Tenn., has been announced in these columns, was born on April 30, 1871, at Smithsburg, Md., and was educated in the high schools of Washington county. He began railway work on June 30, 1888, as a messenger boy on the Western Maryland Railroad, now part of the Western Maryland Railway, and learned telegraphy while in that position. Two years later he became operator on the Pocohontas division of the Norfolk & Western, and was made despatcher in November, 1892. He was promoted to chief despatcher in March, 1900, and became assistant trainmaster in June, 1904. In September of the following year he was made trainmaster of the same road, and in October, 1908, he was appointed superintendent of the Carolina, Clinchfield & Ohio, which position he held at the time of his recent appointment as general superintendent of that road.

Wilbur T. Hall, whose appointment as superintendent of the Houston & Texas Central, with office at Ennis, Tex., has been announced in these columns, was born June 30, 1865, at Lewis Center, Ohio. He was educated in the county graded schools, and began railway work in 1885 with the Cleveland, Cincinnati, Chicago & St. Louis as a brakeman. He was later telegraph operator and switchman on that road, and in 1891 went with the Cleveland, Lorain & Wheeling, where he was consecutively, telegraph operator, train despatcher, yardmaster and conductor. In 1904 he left the Cleveland, Lorain & Wheeling, which had been absorbed by the Baltimore & Ohio in 1900, and from November, 1904, to August, 1905, was engine foreman on the Houston & Texas Central. He was then made chief clerk to the superintendent of terminals at Houston, and from February of the following year until November, 1908, was yardmaster at Houston. He was promoted to trainmaster on November 18, 1908, and to assistant superintendent on August 1, 1909, from which office he has just been promoted.

A change has been made in the operating organization of the Pere Marquette by which three new divisions have been created. F. Hartenstein, superintendent at Grand Rapids, continues in charge of the Grand Rapids division, with jurisdiction over the line from Detroit to Chicago and several branches therefrom; A. R. Merrick, superintendent at Saginaw, Mich., continues in charge of the Saginaw division, which comprises the line from Toledo, Ohio, to Ludington, Mich., three branches from Saginaw, Mich., several other branches, Plymouth station and yards and Baldwin station and yards; W. K. Tasker, superintendent at Detroit, Mich., has been appointed superintendent of the Buffalo division, with office at Port Huron, Mich., this division comprising the line from Port Huron to Grindstone City, several branches from Port Huron, the lines from Walkerville to St. Thomas, from London to Port Stanley, from Sarnia to Rondeau, from Windsor to Walkerville Junction, and the ferry service at Port Huron; J. E. Church, trainmaster at Detroit, Mich., has been appointed superintendent of the Ionia division, with office at Ionia, Mich., his jurisdiction extending over the lines from Grand Ledge to Big Rapids, including the station and yards at the latter place and several other branches; W. H. Romoser, trainmaster at Grand Rapids, Mich., has been appointed superintendent of the Petoskey division, with office at Traverse City, Mich., his jurisdiction to extend over the lines from Petoskey to Comstock Park, from Rapid City to Stratford, from Williamsburg to Elk Rapids, from Clary to Honor, and from Big Rapids to Berry.

Traffic Officers.

J. H. Ketner has been appointed assistant to the general freight agent of the Seaboard Air Line, with office at Norfolk, Va.

W. F. Lincoln has been appointed assistant general freight agent of the San Pedro, Los Angeles & Salt Lake, with office at Los Angeles, Cal.

James Menzies, general freight agent of the Atlantic Coast Line for the lines south of Charleston, S. C., at Savannah, Ga., has been appointed freight traffic manager, with office at Savannah, succeeding, R. A. Brand, promoted. C. McD. Davis, assistant general freight agent at Wilmington, N. C., succeeds Mr. Menzies, with office at Savannah, Ga., and Robert N. Nash, chief clerk, in the freight traffic department, succeeds Mr. Davis, with office at Wilmington. See Executive, Financial and Legal.

E. S. Morgan, commercial agent of the New Orleans & Northeastern, the Alabama & Vicksburg and the Vicksburg, Shreveport & Pacific at Dallas, Tex., has been appointed general western agent of the Queen & Crescent Route, with office at Dallas, his jurisdiction to extend over the above lines and the Cincinnati, New Orleans & Texas Pacific and the Alabama Great Southern. W. H. Timberlake, who has been commercial agent of the two latter roads at Dallas, has been appointed commercial agent of all the lines, with office at Houston, Tex. L. R. Gardner, traveling freight agent of the three roads first mentioned at Dallas, has been appointed traveling freight agent of the system, with office at San Antonio, Tex., where a new office has been opened. G. C. Whitney has been appointed traveling freight agent, with office at Dallas. G. F. Kay has been appointed soliciting freight agent, with office at Houston.

Engineering and Rolling Stock Officers.

G. C. Millett has been appointed engineer of the Atchison Topeka & Santa Fe Coast Lines, with office at Los Angeles, Cal., succeeding R. J. Arey, resigned.

H. S. Elliott, assistant engineer of the Erie Railroad at Jersey City, N. J., has been appointed division engineer, with office at Hornell, N. Y., succeeding H. C. Landon, resigned to go to another company.

E. H. Harlow, master mechanic of the Atchison, Topeka & Santa Fe Coast Lines, at Richmond, Cal., has been appointed terminal master mechanic, with office at Richmond, and John Pullar, division foreman at Los Angeles has been appointed master mechanic of the Valley division, with office at Fresno, Cal.

Frank L. Burckhalter, whose appointment as district engineer of the Southern Pacific Company, with office at Portland, Ore., has been announced in these columns, was born in California in 1879. He graduated from the University of California in 1900, and in August of that year became a rodman on the Southern Pacific. He was afterward an instrument man, and from February, 1902, to March 1, 1906, was in the maintenance of way department, where he was consecutively assistant engineer, section foreman and roadmaster. On the latter date he became division engineer at Bakersfield, Cal., and in December, 1908, was transferred to Los Angeles, Cal., as division engineer, from which office he was promoted as above on November 1, 1911.

OBITUARY.

M. H. Elkin, division engineer of the Lehigh Valley, died on November 26, at Delano, Pa.

Andrew A. Gallagher, until about four years ago district passenger agent of the Missouri Pacific, with office at Cincinnati, Ohio, died at the residence of his mother in Houston, Tex., on November 23.

L. P. Cunningham, one of the promoters of the Memphis, Carthage & Northwestern, now a part of the 'Frisco System, and for four years president of the M. C. & N. W., died at Joplin, Mo., on November 20.

C. W. Spencer, for three years, 1905-1908, general manager of the eastern lines of the Mackenzie-Mann railways, and formerly for 18 years an officer of the Canadian Pacific, died at Montreal, November 23. Mr. Spencer was born October 31, 1857, at Kempville, Ont., and began railway work in May, 1871, with the Canadian Pacific. Until 1874 he was operator and clerk at Ottawa Station, and was later assistant agent. He then held various positions in the operating department of the Canadian Pacific, until May, 1881, when he became traffic superintendent. The following June he was appointed assistant superintendent, and in August, 1884, he became assistant general superintendent. From October, 1887, to May, 1903, he was general superintendent of the Eastern division, and from May, 1903, to September, 1905, was general superintendent of transportation of the Eastern lines on the same road. Mr. Spencer went to the Mackenzie-Mann System (Canadian Northern) in September, 1905, as general manager, since January, 1908, he had been out of railway work.

Equipment and Supplies.

LOCOMOTIVE BUILDING.

THE VIRGINIAN RAILWAY is in the market for 12 mikado locomotives and 4 Mallet (2-8-8-2) locomotives.

THE NEW YORK CENTRAL LINES have ordered 30 locomotives from the Baldwin Locomotive Works, in addition to the 50 locomotives recently mentioned.

THE ILLINOIS CENTRAL, as mentioned in the *Railway Age Gazette* of November 10, has ordered 40 mikado locomotives from the Baldwin Locomotive Works and 10 Pacific type locomotives from the American Locomotive Company. These locomotives will have the following dimensions:

Type	Mikado	Pacific
Simple or compound	Simple	Simple
Weight on drivers	218,300 lbs.	150,500 lbs.
Total weight	283,850 lbs.	245,000 lbs.
Diameter of cylinders	27 in.	25 in.
Stroke of pistons	30 in.	26 in.
Diameter of drivers	63 in.	75 in.
Type of boiler	Radial stay	Radial stay
Working steam pressure	175 lbs.	180 lbs.
Heating surface, tubes	3,835 sq. ft.	2,689 sq. ft.
Heating surface, firebox	235 sq. ft.	1,865 sq. ft.
Heating surface, total	4,070 sq. ft.	2,875.5 sq. ft.
Tubes, number	262 and 36	189 and 26
Tubes, outside diameter	2 in. and 5⅜ in.	2 in. and 5⅜ in.
Tubes, length	20 ft. 6 in.	20 ft.
Firebox, type	Wide	Wide
Firebox, length	120⅝ in.	102 in.
Firebox, width	84 in.	71⅞ in.
Firebox, material	Steel	Steel
Grate area	70 sq. ft.	51 sq. ft.
Tank capacity	9,000 gals.	9,000 gals.
Coal capacity	15 tons	15 tons
Superheater	Schmidt	Schmidt

CAR BUILDING.

THE NORFOLK SOUTHERN has ordered 500 box cars from the American Car & Foundry Company.

THE CHICAGO, ROCK ISLAND & PACIFIC has ordered 400 automobile cars, 250 flat cars and 25 caboose cars from the Western Steel Car & Foundry Company.

THE GRAND TRUNK has ordered 1,000 box cars from the Pressed Steel Car Company in addition to the 2,000 cars mentioned in the *Railway Age Gazette* of November 17.

THE NORTHERN PACIFIC is said to be in the market for from 1,000 to 2,000 box cars, 1,000 to 2,000 refrigerator cars, and from 500 to 1,000 gondola cars. This item has not been confirmed.

IRON AND STEEL.

THE BALTIMORE & OHIO has ordered 425 tons of structural steel from the Ft. Pitt Bridge Works.

THE ILLINOIS CENTRAL has ordered 500 tons of bridge steel from the American Bridge Company.

THE CHICAGO & ALTON has ordered 150 tons of bridge steel from the American Bridge Company.

THE SPOKANE, PORTLAND & SEATTLE has ordered 100 tons of bridge steel from the American Bridge Company.

THE NEW YORK CENTRAL has ordered 800 tons of structural steel from the McClintic-Marshall Construction Company.

THE CHICAGO, INDIANAPOLIS & LOUISVILLE has ordered 400 tons of structural steel from the Lackawanna Bridge Company.

GENERAL CONDITIONS IN STEEL.—The Steel Corporation is receiving new business at the rate of between 35,000 and 40,000 tons a day and is expected to show a substantial increase in orders this month over last. If new business continues to be received at the present high rate until the end of the year, it is believed that the production for 1911 will establish a new high record. Manufacturers are satisfied with the outlook, for they feel that since they managed to make ends meet while the railways were not buying, conditions will show a great improvement now that the railways have entered the market.

Supply Trade News.

The Safety Car Heating & Lighting Company, New York, has declared an extra dividend of 1 per cent. in addition to the regular quarterly dividend of 2 per cent.

At the annual meeting of the stockholders of the Sherwin-Williams Company, Cleveland, Ohio, Thomas Madill, manager of the Chicago office of the company, was presented with a handsome gold watch on which was engraved "Presented to Thomas Madill by the Sherwin-Williams Company, in commemoration of 25 years of faithful service, September, 1886-1911."

L. R. Pomeroy has opened an office as consulting engineer at 50 Church street, New York. He is prepared to design railway and industrial plants, to advise as to the rehabilitation of shops, to analyze machine tool operation with reference to electric and effective operation, and to make reports and appraisals of railway and manufacturing properties. Mr. Pomeroy has been chief engineer of the railway and industrial division of J. G. White & Company, New York, assistant to the president of the Safety Car Heating & Lighting Company, New York, special representative in the railway field for the General Electric Company, Schenectady, N. Y., and assistant general manager of the Schenectady Locomotive Works. Prior to that he was engaged as a special railway representative for the Cambria Steel Company, Philadelphia, Pa., Latrobe Steel Company and Carnegie Steel Company, Pittsburgh, Pa., and was secretary and treasurer of the Suburban Rapid Transit Company of New York. His earlier experience was in commercial pursuits, bookkeeping, special auditing, drafting and designing cars.

TRADE PUBLICATIONS.

THE LOUISVILLE & NASHVILLE.—The passenger department of this company has published an attractive folder on Cuba and how to get there. The different portions of the island are described in an interesting manner and the points of interest in Havana are given with brief descriptions of each. A list of the best hotels throughout Cuba, with their prices, is also included.

RAILWAY ELECTRIC EQUIPMENT.—The General Electric Company, Schenectady, N. Y., has issued bulletin No. 4891, composed principally of illustrations of the electrical equipment of various railways throughout the country. These illustrations comprise interiors of the power stations, both main and sub-stations, and the rolling stock of various railways. Included among these illustrations are two portable sub-stations.

RAIL BRACES.—The Beaver Dam Malleable Iron Company, Beaver Dam, Wis., has published an illustrated leaflet on its improved rail brace. The feature of this brace is that it has rises at the spike holes to prevent the spike from being driven so far that a claw bar cannot be driven under it to draw out the spike. The brace is made of malleable iron and is claimed to withstand the deteriorating effects of the atmosphere and drippings of brine from refrigerator cars better than steel.

TOOLS.—The McCrosky Reamer Company, Meadville, Pa., has published catalog No. 3 of its "Time and Money-Saving Tools," in which descriptions are given of McCrosky adjustable reamers, Ideal adjustable high-speed machine reamers, Wizard quick-change, chucks and collets, Wizard variable speed and reversing attachment, Wizard friction drive and Noneeda-Tang collets, Wizard turret tap holders, McCrosky expanding mandrels and Searchlight universal lamp brackets. Prices are included.

ASPHALT FLOORS.—The Standard Asphalt & Rubber Company, Chicago, has published an illustrated booklet in which it describes the advantages and wearing qualities of Sarco asphalt mastic floors. It is claimed that heavy trucking, instead of injuring these floors, is good for them. The strength to resist traffic is given by a graded mineral aggregate which reduces the percentage of voids. The elastic and waterproof qualities are attained by filling the voids with Sarco matrix and flux. Specifications for these floors are given and a number of illustrations of installations are included, together with a few examples of results with brief summaries of the adaptability of these floors to the several classes of construction.

Railway Construction.

New Incorporations, Surveys, Etc.

Algoma Central & Hudson Bay.—An officer of the Algoma Eastern, which operates a line from Sudbury, Ont., to Crean Hill, 23 miles, writes that grading work is now under way on an extension from Crean Hill to Little Current. The section from Crean Hill to Whitefish, 43.5 miles is under contract to the Superior Construction Company, Sudbury, and from Whitefish to Little Current, 18 miles, to the O'Boyle Construction Company, Ltd., Sault Ste. Marie, Ont. Track laying is under way on the Crean Hill end. Track has already been laid on some sidings. R. S. McCormick, chief engineer, Sault Ste. Marie, Ont. (August 25, p. 390.)

Algoma Eastern.—See Algoma Central & Hudson Bay.

Angelina & Neches River.—An officer of this company, which operates a line from Keltys, Tex., east to Naclina, 19.9 miles, writes that work is about finished on the extension from Naclina northeast to Chireno, 10.7 miles. J. S. Moore was the contractor. S. W. Henderson, vice-president and general manager, Keltys. (June 19, p. 1332.)

Ashland & Western.—An officer writes that this company, which operates a line from Ashland, Ohio, southeast to Custalaga, 25 miles, has projected an extension from Ashland, north to Wellington, 20 miles. N. P. Ramsey, vice-president and general manager, Ashland.

Atlantic & Western.—An officer of this company, which operates a line from Sanford, N. C., southeast to Jonesboro, thence east to Broadway, 12 miles, writes that surveys are being made for an extension from Broadway, south to Lillington. F. G. Hatton, vice-president, Roanoke, Va.

Bayfield Transfer Railway.—An officer of this company, which operates a line from Bayfield, Wis., via West End and Bayfield, to Red Cliff, about 18 miles, writes that an extension has been projected from Russells west to Superior, 50 miles. J. M. Smith, vice-president, Duluth, Minn.

Beaumont, Waco & Northern.—According to press reports this company, which was recently incorporated in Texas, is planning to take over the Keith Company's logging line (the Beaumont & Saratoga Transportation Company) which extends from Voth, Tex., northwest, 12 miles, also the Miller-Vider Company's line (the Riverside & Gulf) from Milvid, southwesterly, 10 miles. The plans call for building a connecting line, 22 miles long, between these roads. J. F. Keith, president; J. G. Reaves, vice-president and general manager, Beaumont. (November 17, p. 1036.)

Boston & Maine.—This company has bought land, it is said, at Lynn, Mass., to be used for four-tracking work, in connection with the abolition of grade crossings. A. B. Corthell, chief engineer, Boston.

Bowling Green Northern.—An officer writes that the company is planning to begin construction work in the near future. About 90 per cent. of the right-of-way has been secured. The route is from Bowling Green, Ky., northeast to Mammoth Cave, thence northwest to Grayson Springs, 50 miles. Malcolm H. Crump, chief engineer, Bowling Green.

Canadian Pacific.—An officer writes that work is now under way on the Esquimault & Nanaimo, from Duncan's B. C., to Cowichan lake, 19 miles; also from McBride Junction to Courtenay, 45 miles. Moore & Pettrick and the Westholme Lumber Company, both of Victoria, are the contractors. A further extension is projected from Courtenay to Campbell river, 35 miles. J. G. Sullivan, chief engineer, Winnipeg, Man.

California-Western Railroad & Navigation Company.—An officer writes that it is expected to have all of the work finished to complete a 40-mile line from Willits, Cal., which is on the Northwestern Pacific, to Fort Bragg, by January next. L. J. Scoofy, San Francisco, is the contractor. John G. French, superintendent, Fort Bragg.

Carlton & Coast.—This road, which is operated by the Carlton Consolidated Lumber Company, from Carlton, Ore., to Tillamook Gate, about 12 miles, will extend its line to Tillamook, 23 miles. Surveys are now being made. M. L. Johnson, chief engineer, Carlton.

Central Idaho.—See Union Pacific.

Chattanooga, Rome & Atlanta.—Organized in Georgia with $2,000,000 capital, to build an interurban line to connect Chattanooga, Tenn., with Atlanta, Ga., about 85 miles. S. W. Divine, associated with capitalists of Chattanooga are back of the project.

Chicago, Anamosa & Northern.—An officer writes that a contract has been given to the L. E. Myers Construction Company to build an extension from Coggon, Iowa, northwest to Quasqueton, about 15 miles. Track has already been laid on nine miles. The work is fairly heavy. There will be a 300-ft. steel bridge. H. Kiene, president, Dubuque.

Denver & Intermountain.—An officer of this company, which operates a line from Denver, Colo., via Lakewood to Golden, 13 miles, writes that plans are being made to build an extension of 10 miles. William G. Smith, president and general manager, Denver.

Des Chutes Railroad.—See Union Pacific.

Dodge City & Cimarron Valley.—Incorporated in Kansas with $3,600,000 capital, to build a line from Dodge City, Kan., to Kolman, N. M. The incorporators are said to be officers of the Santa Fe.

Durham & South Carolina.—An officer of this company, which operates a line from Durham, N. C., south to Bonsal, 31 miles, writes that work is now under way by the J. T. McKenney Construction Company, Lynchburg, Va., on an extension from Bonsal, southeast to Rawls, 12½ miles. R. A. Honeycutt, chief engineer, Durham, N. C. (October 20, p. 815.)

Eureka & Palisade.—A contract has been given to Chadwick & Sykes, it is said, for re-building the line from Eureka, Nev., north to Palisade, 84 miles. G. D. Abbott, superintendent, Palisade. (November 17, p. 1036.)

Esquimault & Nanaimo.—See Canadian Pacific.

Fairchild & North Eastern.—An officer of this company, which operates a line from Owen, Wis., southwest to Fairchild, 38 miles, writes that an extension has been projected from Fairchild west to Cleghorn, 30 miles. W. Foster, vice-president and general manager, Fairchild, Wis. (September 22, p. 575.)

Fernwood & Gulf.—An officer of this company writes that an extension has been projected from Kokomo, Miss., northeast to Columbia, 12 miles. The road is now in operation from Fernwood east to Kokomo, 32 miles. W. D. Hurt, chief engineer, Fernwood, Miss.

Fresno & Eastern (Electric).—Incorporated in California with $1,500,000 capital to build from Fresno, to Shaver in the Sierra forest reserve, 78 miles. The incorporators include F. M. Meigs, Oakland, Cal., A. B. Dodd, San Francisco, and George A. Aldrich, Audubon, N. J.

Grand Junction & Grand River Valley (Electric).—An officer of this company, which operates a line from Grand Junction, Colo., to Fruita, 16 miles, writes that an extension has been projected from Grand Junction northeast to Clifton, 6 miles. F. E. Phillips, chief engineer, Grand Junction.

Gulf, Florida & Alabama.—An officer writes that this company has bought 63 miles of road from Cantonment, Fla., to Local, Ala., and has given contracts to Charles Merrit, Pensacola, Fla., and the Eastern Construction Company, to build 18 miles between Pensacola and Cantonment, on which work is now under way. Surveys are being made from Local, Ala., to Jasper, 210 miles. G. A. Berry, chief engineer, Pensacola. (November 17, p. 1036.)

Gulf Line.—An officer writes that preliminary surveys are now being made for an extension from Camilla, Ga., to the gulf of Mexico. R. W. Watson, president, 37 Wall street, New York City. (September 8, p. 493.)

Houston, Texas & Central.—An officer writes that contracts have been let to Owen, Levy & Owen, Moore Burnet building, Houston, Tex., for grading work on 13 miles in Lee county, Tex.

This work is on a section of the branch line under construction between Stone City on the Brazos river, and a point at or near Giddings. E. B. Cushing, chief engineer, Houston, Tex. (November 10, p. 975-C.)

HUDSON & MANHATTAN.—An officer writes that this company has completed work, during the past year, on an extension of 1.25 miles from Barrow street, Jersey City, N. J., to Portal, near Prior street. J. V. Davies, chief engineer, New York City.

INDIAN CREEK VALLEY.—An officer writes that this company has projected an extension from Jones Mills, Pa., to Rockwood, 50 miles. S. M. Faust, chief engineer, Connellsville.

KENTUCKY & TENNESSEE RAILWAY.—An officer writes that work is now under way from Hopple, Ky., to Rockcreek, 5 miles. A. M. Cook, Oz, is the contractor. The company now operates a line from Stearns, east to Oz, 10.5 miles. W. T. Culver, vice-president and general manager, Ludington, Mich.

LIBERTY-WHITE.—An officer writes that work is now under way on an extension from Kaigler, Miss., to Tylertown, 15 miles. W. M. White, president and general manager, McComb, Miss. (September 29, p. 616.)

MASTON, ALMA & SOUTHBOUND.—An officer writes that work is now under way by the Alma Lumber Company, building a four-mile extension to Rowland, N. C. A. J. McKinnon, president, Maxton. (June 23, p. 1674.)

MINNEAPOLIS, ST. PAUL & SAULT STE. MARIE.—An officer writes that work is now under way by Foley Bros., Welch & Stewart, St. Paul, Minn., building from Frederic, Wis., north via Webster, Danbury, Markville, Minn., Cloverton, Kingsdale, Belden and Harlis to Boylston, Wis., 73 miles, which is nine miles south of Superior. Track laying has been finished to Kingsdale, 43 miles. There will be a steel bridge 300 ft. long over the St. Croix river with a 1,430-ft. trestle; a 1,600-ft. bridge over the Black river; 1,440-ft. steel bridge over the Nemadji river, and a 75-ft. steel bridge, with a 1,590-ft. trestle over the Clam river. Thos. Greene, chief engineer, Minneapolis, Minn. (June 2, p. 1296.)

OREGON SHORT LINE.—See Union Pacific.

OREGON WASHINGTON RAILROAD & NAVIGATION CO.—See Union Pacific.

PENNSYLVANIA RAILROAD.—This company has let contracts for new construction work, including six miles of track elevation for six tracks, in place of the present four surface tracks, through Rahway, N. J., and Linden, and the elimination of fourteen grade crossings. The elevation in the immediate vicinity of Rahway will be three miles long, and grade crossings will be eliminated at St. George's avenue, Inman avenue, Hazlewood avenue, Commerce street, Milton street, Cherry street, Irving street, Poplar street, Main street, Grand street and Scott avenue. A new station will be built in Rahway; it will be of the most modern type with island platform similar to those at Greenburg, Pa., and West Philadelphia, Pa. In Linden the crossings at Wood avenue, Stiles street and Linden road will be eliminated. New stations will be built at Linden and Scott avenues. The work at Rahway and Linden will necessitate constructing an embankment of nearly 2,000,000 cu. yds. of earth, and will require approximately 150,000 cu. yds. of masonry. The bridges over the streets will consist of steel girders with solid reinforced concrete floors similar to those recently constructed on the elevation at Bristol, Pa. The contractors are the Keystone State Construction Company and James McGraw, both of Philadelphia, Pa. With the completion of this work the company will have eliminated every grade crossing in the thickly populated sections on the New York division. At Bristol, work has just been completed on an entirely new line which eliminates every grade crossing.

QUEBEC CENTRAL.—Application will be made to the Quebec legislature for permission to build a branch through Megantic, Lothbiniere and Levis counties. The projected route is from a point on the main line between Thetford Mines and Broughton, to a connection with the proposed branch from Scotts to Quebec. J. H. Walsh, general manager, Sherbrooke, Que.

SALT LAKE & IDAHO.—See Union Pacific.

SAN DIEGO & ARIZONA.—An officer writes that work is now under way from Valle Redondo, Lower Cal., Mex., to La Puerta, 11.9 miles, and in the United States from Coyote Wells, Cal., to Dixie, 12.4 miles. Robert Sherer & Co., Los Angeles, Cal., and Edgar Bros., El Centro, are the contractors. Surveys are being made between La Puerta, Lower Cal., Mex., and Coyote Wells, Cal., 73.9 miles. E. J. Kallright, chief engineer, San Diego, Cal. (September 15, p. 545.)

SAN FRANCISCO, NAPA & CALISTOGA.—This company, which was recently incorporated in California with $2,000,000 capital and headquarters at San Francisco, announces that it will build from Vallejo to Napa and Calistoga via St. Helena, with branches into Lake, Solana and Sonoma counties. The main line is to be 72 miles long. The incorporators include T. V. Maxwell, G. C. Earl, N. H. Spaulding and C. C. Sullivan. (November 24, p. 1081.)

SAN PEDRO, LOS ANGELES & SALT LAKE.—An officer writes that work is now under way from Moapa, Nev., to St. Thomas, 21.73 miles, and track has been laid on 5.06 miles. The company has also finished work on the high line in the state of Nevada from Guelph to Barclay, 86.9 miles, replacing 84.44 miles abandoned or line changed. This work included the construction of a number of tunnels and new bridges. E. G. Tilton, chief engineer, Los Angeles, Cal.

SOUTHERN PACIFIC.—A contract has been given to Twohy Brothers, it is said, for building 23 miles of the Willamette Pacific, on the Eugene-Coos Bay line in Oregon. The first section to be built is from Eugene, westward. The new line is, eventually, to be extended south along the Pacific coast to Marshfield. W. Hood, chief engineer, San Francisco, Cal. (October 20, p. 816.)

TWIN MOUNTAIN & POTOMAC.—An officer writes that work is now under way building from Keyser, W. Va., south via Burlington, thence to Twin Mountain, about 26 miles. The work is being carried out by the company's men. Maximum grades will be 4 per cent. There will be a steel bridge of 50 ft. and another of 90 ft. The principal commodities to be carried will be fruit and lumber. Track laying has been finished on one mile. E. A. Russells, general manager; J. Clyde Lewis, chief engineer, Keyser, W. Va. (July 28, p. 198.)

UNION PACIFIC.—The report of this company and auxiliary companies, which includes the Oregon Short Line and the Oregon-Washington Railroad & Navigation Co., for the year ended June 30, 1911, shows that there was a net increase of 490.63 miles in mileage of railways owned; 67.29 miles in railways owned jointly; 156.21 miles in railways operated under trackage rights and 169.25 miles in sidings. The changes in line, completed or in course of construction, during the year, were as follows:

Union Pacific.—St. Vrains, Colo., to Grant Mine, 4.90 miles.

Oregon-Washington Railroad & Navigation Company.—Dalles, Ore., to Des Chutes, 14.32 miles; Yoakum, Ore., to Pendleton, 11.44 miles; Hay Canyon, Ore., 1.92 miles.

Construction was also under way on the following lines as well as on about 185 miles of additional main track as follows:

Union Pacific.—Northport, Neb., to Gering, 30.64 miles, track laid on 5.84 miles, grading finished on 12.43 miles, and grading under way on 10 miles; Rock Springs, Wyo., to Kilpecker Creek, 10.40 miles, track laid on 7.45 miles, grading finished on 2.95 miles; Dent, Colo., to Fort Collins, 25.25 miles, track finished on 24.89 miles, and grading finished on 0.36 miles.

Oregon Short Line.—Rupert, Idaho, to Bliss, 72.78 miles, track laid on: 63.78 miles, and grading finished on 9 miles; Burley, Idaho, to Oakley, 22.09 miles, track laid on 22.06 miles, and grading finished on 0.02 miles; Ashton to Driggs, 37.50 miles, track laid on 4.47 miles, grading finished on 7.98 miles, and grading under way on 20 miles; Montpelier to Paris, 9.50 miles, track-laying has been completed; Caldwell westerly via Greenleaf, 11.31 miles, all of the track laying has been completed. Nyssa to Homedale, 26 miles, grading finished on two miles and grading under way on 7.79 miles.

Central Idaho Railroad.—Richfield, Idaho, to Taft, 58.20 miles, grading finished on 0.37 miles, and grading under way on 7.86 miles.

Salt Lake & Idaho.—Burley, Idaho, to Kelton Summit on the Utah-Idaho line, 60.50 miles, grading finished on one mile, and grading under way on 17.08 miles.

Oregon-Washington Railroad & Navigation Company.—Albina, Ore., to Mock Battom, 1.25 miles, track laying has been finished; Cosmopolis-North River line, in the state of Washington, 12 miles, track laid on 6.32 miles, grading finished on 4.98, and grading under way on 0.70 miles; Spokane to Ayer Junction, 103.95 miles, grading finished on 66.41 miles and grading under way on 35.54 miles.

Des Chutes Railroad.—Des Chutes, Ore., to Redmond, 10 miles, grading finished on 9.25 miles, and grading under way on 0.75 miles.

Willamette Pacific.—See Southern Pacific.

RAILWAY STRUCTURES.

Abilene, Tex.—The Abilene & Southern roundhouse was burned on November 17, with an estimated loss of $25,000.

Brownsville, Tex.—The St. Louis, Brownsville & Mexico has let the contract for building a freight house 240 ft. x 30 ft., to replace the structure recently destroyed by fire. The new building will cost about $14,000.

Charter Oak, Cal.—The Southern Pacific will build a new station, it is said, at Charter Oak.

Colfax, Wash.—The Spokane & Inland Empire has given a contract to J. R. Good & Co., for building a passenger station at Colfax. (November 3, p. 932.)

Frederic, Wis.—See Minneapolis, St. Paul & Sault Ste. Marie, under Railway Construction.

Linden, N. J.—See Pennsylvania Railroad, under Railway Construction.

Lynn, Mass.—See Boston & Maine, under Railway Construction.

Portland, Ore.—The report of the Union Pacific for the year ended June 30 shows that a large amount of money was spent during the year for new bridges, trestles and culverts. This work included the new steel bridge over the Willamette river at Portland, also the renewal of bridges on various sections made necessary by the construction of second main track. There was also a large amount of money spent for new buildings.

Rahway, N. J.—See Pennsylvania Railroad, under Railway Construction.

San Bernardino, Cal.—The Atchison, Topeka & Santa Fe will make improvements and additions to its shops at San Bernardino, Cal. It is said that a new blacksmith shop will be built. The estimated cost of the improvements is $250,000.

Spokane, Wash.—The plans submitted by the Chicago, Milwaukee & Puget Sound, for the construction of concrete viaducts over Helena, Medelia, Hogan, Perry and Denver streets, have been approved by the Board of Public Works.

Victorville, Cal.—A contract has been given by the Atchison, Topeka & Santa Fe to the Sharp-Fellows Company, Los Angeles, Cal., for erecting a concrete retaining wall at the bridge over the Mojave river near Victorville.

Wheaton, Ill.—The Aurora, Elgin & Chicago has let the contract for building a one-story brick passenger station 35 ft. x 100 ft., to cost about $25,000. H. R. Wilson & Co., Chicago, are the architects.

The Northern Railway, Siam, has been completed to Sala Me Puak, and trains are running regularly to that point. It is now contemplated to extend the line about four miles northwesterly to Den Chai, and make this the terminus of the railway for the present. From Den Chai a road would be made to Phrae by the government and motor cars would be run over this to carry passengers and freight in connection with the trains. The ground between Den Chai and Phrae is almost level, and the cost of a road will be much less than that of one from Sala Me Puak to Phrae. Den Chai is also preferred as a terminus, because it is on a broad level plain, furnishing plenty of room for the construction of sheds and tracks for railway yards, whereas the level space at Sala Me Puak is too confined. The expense of leveling extra ground at the latter place would be very heavy.

Railway Financial News.

Ashville & East Tennessee.—Control of this road, which runs from Ashville, N. C., to Weaverville, has been bought by John H. Carter, of Ashville.

Buffalo, Rochester & Pittsburgh.—Hampton F. Kean has been elected a director, succeeding Lanfear Norrie, deceased.

Cincinnati, New Orleans & Texas Pacific.—Daniel Willard, president of the Baltimore & Ohio; W. F. Loree, president of the Delaware & Hudson, and M. R. Wait have been elected directors, succeeding William Cotter, president of the Pere Marquette; George W. Perkins, until recently a member of the firm of J. P. Morgan & Co., New York, and Norman B. Ream, resigned.

Fitchburg-Railroad.—This company has asked the Massachusetts railway commission for authority to issue $1,200,000 4½ per cent. bonds, the proceeds to be used to refund $100,000 Brookline & Pepperell bonds maturing December 1, and to reimburse the Boston & Maine for additions and betterments.

Minneapolis, St. Paul & Sault Ste. Marie.—It is understood that arrangements have been made for the sale of $6,000,000 4 per cent. bonds, to be secured by a first mortgage on the Soo's terminals which are to be built at Chicago.

New York Central & Hudson River.—See an item in regard to this company's relations with the Rutland Railroad in Traffic News.

Norfolk Southern.—This company has taken over the Raleigh & Southport, the Durham & Charlotte and the Aberdeen & Asheboro. The roads acquired have an aggregate mileage of 228 miles. The Raleigh & Southport was financed by F. J. Lisman & Co., New York, and these bankers made the negotiations for the sale of the other two roads.

Redmond & Co., New York, are offering $5,762,000 first and refunding mortgage 5 per cent. bonds of February 1, 1911-1961, of the Norfolk Southern at 101. The bonds are secured at the rate of not less than $11,500 per mile on over 508 miles of road, and of this mileage, 215 miles is subject to the first lien of these bonds. The remaining 293 miles is subject to underlying liens averaging about $10,720 per mile.

Pennsylvania.—See an item in regard to this company's possible relations with the Atlantic Coast Line in General News.

Rutland.—See an item in regard to this company's relations with the New York Central & Hudson River in Traffic News.

FOREIGN RAILWAY NOTES.

About 50,000 coolies have been employed steadily during the year on the Kirin-Chanchun Railway, Central Manchuria. A temporary mountain line is proposed over the Tumenling pass, to be used until the tunnel is completed. Seventy per cent. of the earth work is reported completed, and it is expected that rails will be laid to Kirin by the end of the year.

The construction work of connecting India with Ceylon is progressing rapidly. There are 156 piers, the span being 40 ft., and in addition there is a 200 ft. Scherzer rolling bridge, over the Pamban channel. The work is progressing simultaneously from both ends, the work on the Indian side being of an exceptionally difficult nature. The founding of the pier is a matter of unusual difficulty owing to the uneven and fissured bottom and also to the strong current. The work of sinking the piers is making considerable progress, and it is estimated that at least one pier per week will be completed. The construction of coolie lines, segregation camp and hospital is also proceeding rapidly. The work of constructing the north and south piers at Dhanushkodi will be taken in hand shortly. Among the works to be started in the near future are the residence of the marine superintendent, huts for coolies, and coal storage grounds. Owing to a difference of opinion regarding the bridge across the Pamban channel, the work on the Indian side was very much delayed, while the Ceylon government in the meantime has been forging ahead and got at least one year's start at Talai Mannar. Vigorous efforts are being made to make up for lost time, and it is hoped to commence the service in August, 1913.

ANNUAL REPORT

UNION PACIFIC RAILROAD COMPANY—FOURTEENTH ANNUAL REPORT.

REPORT OF THE BOARD OF DIRECTORS.

INCOME FOR THE YEAR.

The gross revenues and expenses of the Union Pacific Railroad and Auxiliary Companies, after excluding all offsetting accounts between them, were as follows:

	This Year.	Last Year.	+Increase. —Decrease.
Average miles of railway operated during the year	6,678.29	6,296.22	+ 382.07
TRANSPORTATION OPERATIONS.			
Gross operating revenues	$87,201,971.38	$88,506,465.44	—$1,304,494.06
Outside operations—revenues	1,781,136.43	1,721,626.76	+ 59,509.67
Total revenue	$88,983,107.81	$90,228,092.20	—$1,244,984.39
Operating expenses	$47,907,772.31	$45,148,270.47	+$2,759,501.84
Outside operations—expenses	1,900,061.68	1,790,638.87	+ 109,422.81
Taxes	3,464,147.20	3,264,347.51	+ 199,799.69
Total expenses and taxes	$53,271,981.19	$50,203,256.85	+$3,068,724.34
Operating revenues over expenses and taxes	$35,711,126.62	$40,024,835.35	—$4,313,708.73
Charges.			
Interest on funded debt in hands of the public (Table 15)	$12,623,281.83	$12,455,577.15	+ $167,704.68
Sinking fund requirements	12,013.33	16,013.33	— 4,000.00
Hire of equipment—balance	1,742,562.63	1,923,095.63	— 180,533.00
Rentals for lease of road—balance	15,676.73	14,928.71	+ 748.02
Total	$14,393,534.52	$14,409,614.82	— $16,080.30
Deduction:			
Rentals from joint tracks, yards and terminal facilities—balance $147,716.49			
Miscellaneous rentals—balance 111,320.89			
Miscellaneous income 2,560.34	261,597.72	378,418.51	— 116,820.79
	$14,131,936.80	$14,031,196.31	+ $100,740.49
Surplus from transportation operations after payment of charges	$21,579,189.82	$25,993,639.04	—$4,414,449.22
Application of Surplus.			
Dividends on stocks of Union Pacific Railroad Co.:			
4 per cent. on preferred stock	$3,981,744.00	$3,981,760.00	— $16.00
6 per cent. on common stock	12,995,742.91	13,022,319.50	— 26,576.59
Dividends on preferred stock of the Oregon Railroad and Navigation Co. in hands of the public	.....	240.00	— 240.00
	$16,977,486.91	$17,004,319.50	— $26,832.59
Surplus after payment of dividends	$4,601,702.91	$8,989,319.54	—$4,387,616.63
INCOME OTHER THAN FROM TRANSPORTATION OPERATIONS.			
Interest on bonds owned of companies other than Oregon Short Line Railroad and Oregon-Washington Railroad and Navigation Cos. (Table 16)	$1,392,509.01	$1,263,983.16	+ $128,525.85
Dividends on stocks owned of companies other than Oregon Short Line Railroad and Oregon-Washington Railroad and Navigation Cos. (Table 17)	14,596,701.50	15,298,078.00	— *701,376.50
Balance of interest on loans and on open accounts other than with Auxiliary Companies	2,016,541.69	2,559,720.18	— 543,178.49
Rentals from steamships	304,800.00	304,800.00	
Net income from lease of unpledged lands and town lots.	26.54	928.13	— 901.59
Miscellaneous income	87,089.76	87,318.40	— 228.64
Total	$18,397,668.50	$19,514,827.87	—$1,117,159.37
Less—Miscellaneous payments.	1,097.27	2,776.52	— 1,679.25
Total income other than from transportation operations	$18,396,571.23	$19,512,051.35	—$1,115,480.12
Deduction:			
Dividends on stocks of Union Pacific Railroad Co.:			
4 per cent. on common stock	8,663,828.60	8,681,546.35	— 17,717.75
Surplus income other than from transportation operations	$9,732,742.63	$10,830,505.00	—$1,097,762.37
Total surplus from transportation operations and from other income after payment of dividends	$14,334,445.54	$19,819,824.54	—$5,485,379.00

*Resulted principally from a dividend of $438,000 received last year on common stock, Southern Pacific Co., exchanged for preferred stock and from a decrease this year of $206,862 in dividends on preferred stock of Chicago & Alton R. R. Co.

The results of the year's operations, compared with those of the preceding year, were as follows:

	Increase.	Decrease.	Per Cent.
Average miles of railways operated	382.07	.....	6.07
Gross operating revenues and revenues from outside operations	.....	$1,244,984.39	1.38
Operating expenses and expenses of outside operations	$2,868,924.65	.....	6.11
Taxes	199,799.69	.....	6.12
Transportation revenue over expenses and taxes	.....	4,313,708.73	10.78
Income other than from transportation operations	.....	1,115,480.12	5.71
Total income	.....	5,429,188.85	9.11
Interest on funded debt and other charges	100,740.49	.....	.72
Surplus over interest and charges	.....	5,529,929.34	12.15

ASSETS AND LIABILITIES.

The assets and liabilities of the Union Pacific Railroad and Auxiliary Companies are shown in detail in Table No. 5. The securities owned are stated after eliminating all offsetting accounts between the companies, thus dealing only with the securities in the hands of the public, the assets collectible from the public, and the liabilities payable to the public.

The increase or decrease in assets or liabilities since last report, briefly stated, is as follows:

Increase in Assets:			
Cost of railways, equipment, and other property as detailed under Capital Expenditures			$39,295,633.40
Stocks and Bonds:			
Balance of profit realized by Oregon Short Line Railroad Co. from the sale of Northern Securities stocks and stocks received in exchange therefor		$53,728,678.46	
Stocks and bonds disposed of or acquired, as detailed in Tables 9, 10 and 11:			
Stocks sold	$22,555.00		
Stocks of proprietary companies retired	339,000.00		
Bonds sold	157,200.00		
Bonds of proprietary companies retired	4,236,500.00		
Bonds transferred to other accounts	161,000.00	$4,916,255.00	
Less:			
Stocks purchased	$1,075,147.49		
Stocks acquired in settlement of accounts.	305,186.41		
Bonds purchased	200,881.00		
Bonds acquired in settlement of accounts.	876,600.00	2,457,814.90	
Stocks and bonds disposed of in excess of stocks and bonds acquired		2,458,440.10	
Balance			51,270,238.36
Demand loans to Southern Pacific Co.			9,105,736.44
Other demand loans and time deposits			1,450,000.00
Loans to San Pedro, Los Angeles & Salt Lake R. R. Co.			1,168,860.00
Loans to Utah Light & Railway Co			971,345.51
Cash on hand			3,088,923.06
Contingent unadjusted accounts			57,156.68
			$106,407,893.45
Deduct for decrease in:			
Material, fuel and supplies		$100,717.14	
Due from Proprietary Companies		267,804.77	
Current cash accounts		1,184,237.45	
			1,552,759.36
Net increase in assets			$104,855,134.09
Increase in Liabilities:			
Capital stock	$27,690.00		
Funded debt	31,783,230.00		
Due to Proprietary Companies	319,698.46		
Current cash accounts	1,658,640.04		
Contingent unadjusted accounts	672,332.83	$34,461,591.33	
Deduct for decrease in:			
Reserve for depreciation on steamships, equipment, and miscellaneous property		724,741.17	
			33,736,850.16
Increase in assets in excess of increase in liabilities (gain in Profit and Loss)			$71,118,283.93

The increase in the book value of stocks and bonds owned results from the disposition made in this year's accounts of the profits realized from

the sale of the Northern Securities Company stock and the securities received in the distribution of said company's assets. Pending final adjustment, the entire proceeds from the sales of these securities were treated as a credit against the cost of stocks and bonds, thus diminishing the book cost of all stocks and bonds by the amount of the profits realized from their sale. The investment stocks, costing $223,795,629.80, are shown in detail in Table No. 10. On June 30, 1911, their market value was about $267,000,000.

The profits realized by the Oregon Short Line Railroad Company from its original investment in the 824,918.71 shares of the capital stock of the Northern Securities Company and from the sale of the stocks which it received under subscription rights to the stocks of the Great Northern Railway Company and the Northern Pacific Railway Company received in the distribution of the assets of the Northern Securities Company were $58,684,157.76. Of this sum $4,955,479.30 was taken up by the Oregon Short Line Railroad Company in its Profit and Loss account in the year 1905; the remaining $53,728,678.46 was taken over this year. This year the profit was distributed as a dividend on the shares of the Oregon Short Line Railroad Company, all of which are owned by the Union Pacific Railroad Company.

CAPITAL EXPENDITURES.

The charges to capital account other than for stocks and bonds in companies other than the Union Pacific Railroad and Auxiliary Companies, amounted to $39,295,633.40, and were as follows:

For account of extensions and branches, viz.:		
Union Pacific Railroad Company:		
Callaway to Gandy, Nebraska..	$10,752.78	
Northport to Gering, Nebraska.	235,928.98	
O'Fallons to Northport, Nebraska	8,424.23	
Pine Bluffs, Wyoming to Brownson, Nebraska	1,909.67	
Rock Springs to Coal Fields, Wyoming	89,752.65	
Onaga to Marysville, Kansas..	79,750.33	
Cloverly to Hungerford, Colorado	19,240.10	
Dent to Fort Collins, Colorado.	477,624.46	
Grants Mine to La Salle, Colorado	94,665.73	
Greeley Junction to Briggsdale, Colorado	7,358.96	
Sand Creek to St. Vrains, Colorado	61,625.86	
	$1,087,013.75	
Credit: Line Stromsburg to Central City, Nebraska	91.20	
		$1,086,922.55
Oregon Short Line Railroad Company:		
Ashton to Driggs, Idaho	$321,860.68	
Burley to Oakley, Idaho	150,792.55	
Caldwell to Mile Post Eleven, Idaho	79,107.43	
Montpelier to Paris, Idaho....	136,786.21	
Moreland to Aberdeen, Idaho.	4,047.24	
Nyssa to Homedale, Idaho.....	73,540.08	
Rupert to Bliss, Idaho.....	370,108.67	
Twin Falls to Rogerson, Idaho	11,345.56	
	$1,147,588.42	
Credit: Line St. Anthony, Idaho, to Yellowstone, Montana....	850.71	
		1,146,737.71
Oregon-Washington Railroad & Navigation Company:		
Blakes, Oregon to Lewiston, Idaho	$133,418.49	
Coyote to Stanfield, Oregon....	1,270.80	
Grays Harbor Line, Washington	476,469.83	
Portland, Oregon to Seattle, Washington	992,219.65	
St. Johns to Troutdale, Oregon.	303,609.70	
Spokane Division, Washington.	834,030.46	
Spokane Terminals, Washington	251,353.85	
Vale to Odell, Oregon.....	3,375.12	
Yakima Division, Washington.	488,548.10	
	$3,484,296.00	
Credit: Line Vale to Brogan, Oregon	31,555.55	
	3,452,740.45	
		$5,686,400.71
Construction expenditures and charges prior to October 31, 1910, on railways acquired by the Oregon Short Line Railroad Company..	.....	853,587.62
Construction expenditures and charges prior to December 23, 1910, on railways acquired by the Oregon-Washington Railroad and Navigation Company	$7,509,106.38	
Cost of stocks and bonds, carried last year as stocks and bonds owned, and other accounts taken over this year into cost of railways	4,795,165.46	
		12,304,271.84
Expenditures for Additions and Betterments (Table No. 25), viz.:		
Roadway, Track and Appurtenances:		
Ballast	$144,003.12	
Bridges, trestles, culverts, and grads crossings	1,195,135.87	
Changes in line, revision of grades, widening embankments, and tunnel improvements....	1,174,212.87	
Increased weight of rails, improved frogs and switches, track fastenings and appurtenances	408,827.75	
Interlocking, block, and highway crossing signals.....	281,293.03	
Additional main tracks.....	3,693,255.77	
Real estate, right-of-way and station grounds, and fencing right-of-way,	146,447.08	
Sidings and passing tracks....	672,675.99	
Telegraph and telephone lines.	53,207.79	
		$7,769,059.27
Buildings, Structures and Appurtenances:		
Enginehouses, shops, machinery, tools, etc.	$522,482.22	
Roadway buildings, machinery, tools, etc.	22,152.89	
Station buildings, terminal yards, and appurtenances	374,134.69	
Water and fuel stations.....	431,809.01	
Other buildings—general service	814,024.57	
	2,164,603.38	
Equipment:		
Additions and improvements to existing equipment	$36,451.37	
174 locomotives	2,325,722.69	
179 passenger-train cars	1,473,719.11	
7,639 freight-train cars	6,171,908.11	
775 work equipment	256,169.07	
	$10,263,970.35	
Less:		
1 locomotive, 7 passenger-train, 1,320 freight-train and 285 work equipment cars, vacated during the year.....	914,457.87	
	9,349,512.48	
		19,283,175.13
Advances during the year, not taken over into "Cost of railways, equipment and appurtenances":		
For the construction and acquisition of new lines	$3,624,208.07	
For terminal lands and other property.....	75,152.97	
For rolling stock	165,259.57	
		3,864,620.61
Payments for account of ocean steamships "Bear" and "Beaver"		58,972.44
Improvements to Northern Pacific Terminal property, Portland, Oregon		4,744.73
Total charges		$42,055,773.08
Deduct for:		
Amount received from the Trustee of the Union Pacific Railroad Company's First Railroad and Land Grant Mortgage, in payment for expenditures for additions, betterments and improvements, etc., not otherwise provided for	$1,350,000.00	
Surveys and construction expenditures on lines subsequently abandoned, written off to "Profit & Loss"	641,050.25	
Abandoned property not to be replaced.....	165,487.11	
Transferred to other accounts.....	595,653.28	
Adjustment in amount heretofore deducted from "Cost of railways, equipment and appurtenances" on account of the difference between the face value of stocks and bonds of the Auxiliary Companies retired this year and their cost to the purchaser.....	7,949.04	
		2,760,139.68
Net charges to capital account.....		$39,295,633.40

EQUIPMENT.

The changes in the equipment during the year were as follows:

	Condemned, Destroyed, Sold or Transferred to Another Class and Credited to "Equipment."	Added and Charged to "Equipment." By Purchase.	Added and Charged to "Equipment." By Acquisition of New Lines	Owned by Union Pacific Equipment Association.	Total.
	Number.	Number.	Number.	Number.	Number.
Locomotives	(a) 1	1(b) 110	(c) 11	(d) 76	(e) 197
Baggage cars	...	37	...	*16	21
Baggage and mail cars...	...	16	...	*16	...
Baggage and passenger cars	...	1	4	...	5
Business cars	...	1	..	...	1
Chair cars	...	5	..	25	30
Dining cars	...	11	2	...	13
Motor cars (gasoline)...	...	2	2	...	4
Observation cars	...	4	...	1	5
Passenger cars	1	42	1	*31	12
Postal	6	6	...	34	40
Narrow gauge cars.....	...	....	10	...	10
Total passenger-train cars	(f) 7	(g) 125	(h) 19	(i) *3	(j) 141
Box cars	730	2,941	627	*1,692	1,876
Box automobile cars.....	...	...	...	500	500
Caboose cars	16	96	17	*3	110
Flat cars	4	400	331	*100	631
Furniture cars	107	...	...	...	...
Gondola cars	268	7	100	...	107
Gondola (D. B.) cars....	...	899	50	*499	450
Gondola (H. B.) cars....	37	100	...	*100	...
Refrigerator cars	18	...	...	...	...
Stock cars	140	899	100	*500	499
Narrow gauge cars.....	...	...	59	...	59
Total freight-train cars	(k) 1,320	(l) 5,342	(m) 1,284	(n) *2,394	(o) 4,232
Work equipment.....	(p) 285	(q) 550	(r) 217	(s) 613	(t) 1,380

(a) The original cost of this locomotive was $10,352.89.
(b) The cost of these 110 locomotives was $1,462,673.52.
(c) The cost of these 11 locomotives was $66,095.96.
(d) The cost of these 76 locomotives was $1,757,984.55.
(e) The cost of the total 197 locomotives was $3,286,754.03.
(f) The original cost of these seven passenger-train cars was $38,260.44.
(g) The cost of these 125 passenger-train cars was $1,123,061.99.
(h) The cost of these 19 passenger-train cars was $107,024.86.
(i) The cost of these three passenger-train cars was ‡$152,793.10.
(j) The cost of the total 141 passenger-train cars was $1,382,879.95.

(k) The original cost of these 1,320 freight-train cars was $761,602.31.
(l) The cost of these 5,342 freight-train cars was $5,351,550.72.
(m) The cost of these 1,284 freight-train cars was $1,198,147.98.
(n) The cost of these 2,394 freight-train cars was $2,536,174.71.
(o) The cost of the total 4,232 freight-train cars was $4,013,523.99.
(p) The original cost of these 285 pieces of work equipment was $104,-242.23.
(q) The cost of these 550 pieces of work equipment was $227,745.81.
(r) The cost of these 217 pieces of work equipment was $225,735.91.
(s) The cost of these 613 pieces of work equipment was $681,582.93.
(t) The cost of the total 1,380 pieces of work equipment was $1,135,-064.65.

The total original cost of all the equipment condemned, destroyed, sold or transferred to another class and credited to "equipment" was $914,457.87.

The total cost of all equipment added and charged to "equipment" by purchase was $8,165,032.04; and by acquisition of new lines, $1,597,004.71.

The total net cost of all equipment owned by the Union Pacific Equipment Association was $56,185.87.

The grand total cost was $9,818,222.62.

*Credit—Sold to Union Pacific Railroad, Oregon Short Line Railroad and Oregon Railroad & Navigation Companies.

‡The greater cost of the steel cars added during the year has exceeded the cost of the greater number of wooden cars vacated.

The original cost, salvage value, and amount charged to the operating expenses of the equipment retired during the year were as follows:

	Total.	Locomotives.	Passenger-Train Cars.	Freight-Train Cars.	Work Equipment.
Original cost (estimated if not known)	$914,457.87	$10,352.89	$38,260.44	$761,602.31	$104,242.23
Proceeds from sale or salvage value	293,026.93	2,645.31	16,798.02	239,734.76	33,848.84
Charged to operating expenses	$621,430.94	$7,707.58	$21,462.42	$521,867.55	$70,393.39

The locomotives added during the year averaged 119.63 tons total weight of engine, without tender, and 88.70 tons upon drivers, and freight-train cars 48.44 tons capacity.

The number of locomotives and cars of standard gauge owned and the total and the average capacity of freight-train cars at the close of the year were as follows:

Standard Gauge.	This Year.	Last Year.	Increase.	Per Cent.
Locomotives	1,324	1,133	191	16.86
Total weight, excluding tender (tons)	117,486	95,596	21,890	22.90
Average total weight, excluding tender (tons)	88.74	87.82	.92	1.05
Total weight on drivers (tons)	95,504	78,841	16,663	21.13
Average total weight on drivers (tons)	72.13	69.52	2.61	3.75
Passenger-train cars	948	824	124	15.05
Freight-train cars	28,896	26,043	2,853	10.95
Total capacity (tons)	1,180,547	1,014,311	166,236	16.39
Average capacity (tons)	41.60	39.59	2.01	5.08
Work equipment	5,781	4,686	1,095	23.37

The equipment owned by the respective companies is shown in Table No. 24. The changes during the year, the capacity, and the service of all equipment are shown in Tables Nos. 30, 31 and 32.

TRANSPORTATION OPERATIONS.

The results of the year's transportation operations compared with those of the preceding year are as follows:

	This Year.	Last Year.	Increase or Decrease.	Per Cent.
Average miles of railway operated	6,678.29	6,296.22	382.07	6.07
Revenues.				
Freight	$59,964,363.73	$61,479,679.70	—$1,515,315.97	2.46
Passenger, including excess baggage	20,981,404.90	20,814,819.96	166,584.94	.80
Mail and express	4,637,739.26	4,509,434.37	128,304.89	2.85
Switching, rentals, and all other sources	1,618,463.49	1,702,531.41	—84,067.92	4.94
Total, rail lines	$87,201,971.38	$88,506,465.44	—$1,304,494.06	1.47
Outside operations—revenues	1,781,136.43	1,721,626.76	59,509.67	3.46
Total revenues	$88,983,107.81	$90,228,092.20	—$1,244,984.39	1.38
Operating Expenses.				
Maintenance of way and structures	$10,445,203.37	$9,915,481.65	$529,721.72	5.34
Maintenance of equipment	9,208,724.95	9,074,653.39	134,071.56	1.48
Traffic expenses	2,021,491.93	1,985,017.61	36,474.32	1.84
Transportation expenses	23,991,335.10	22,208,261.51	1,783,073.59	8.03
General expenses	2,241,016.96	1,964,856.31	276,160.65	14.06
Total, rail lines	$47,907,772.31	$45,148,270.47	$2,759,501.84	6.11
Outside operations — expenses	1,900,061.68	1,790,638.87	109,422.81	6.11
Total expenses	$49,807,833.99	$46,938,909.34	$2,868,924.65	6.11
Operating revenues over expenses	$39,175,273.82	$43,289,182.86	—$4,113,909.04	9.50
Freight Traffic. (*Commercial Freight Only —Way-bill Tonnage.*)				
Tons of freight carried	14,807,161	15,312,211	—505,050	3.30
Tons of freight carried one mile	5,803,802,346	5,997,233,894	—193,431,548	3.23
Revenue per mile of road	$8,716.88	$9,764.54	—$1,047.66	10.73
Revenue per *revenue train* mile (*a*)	$4.43	$4.62	—$0.19	4.11
Average revenue per ton per mile	1.003 cents	1.024 cents	—.021 cents	2.05
Average distance carried	391.96 miles	391.66 miles	.30 miles	.08
Passenger Traffic.				
Revenue passengers carried	8,574,527	8,306,930	267,597	3.22
Revenue passengers carried one mile	934,002,700	960,734,984	—26,732,284	2.78
Revenue from passenger trains per mile of road	$3,836.18	$4,022.14	—$185.96	4.62
Revenue from passenger trains per *revenue train mile* (*b*)	$1.48	$1.63	—$0.15	9.20
Average revenue per passenger per mile	2.199 cents	2.122 cents	.077 cents	3.63
Average distance carried	108.93 miles	115.65 miles	—6.72 miles	5.81

(*a*) Revenue freight trains and all mixed train miles.
(*b*) Revenue passenger trains and all mixed train miles including miles run by motor cars.

Compared with the preceding year, the per cent. of operating expenses (including expenses of outside operations) to the gross revenues (including revenues from outside operations) was as follows:

	Rail Lines Only.		Rail Lines and Outside Operations.	
	This Year.	Last Year.	This Year.	Last Year.
For "Maintenance" (*Maintenance of Way and Structures, and Maintenance of Equipment*)	22.54	21.46		
For "Operation" (*Traffic Expenses, Transportation Expenses and General Expenses*)	32.40	29.55		
Total	54.94	51.01	55.97	52.02

The operating revenues and operating expenses for the year distributed among the respective primary accounts provided for in the classification of the Interstate Commerce Commission are shown in Table No. 26. The details of passenger and freight traffic are shown in Tables Nos. 27 and 28.

The expenses of the rail lines for "Maintenance" increased $663,793.28, or 3.50 per cent., and for "Operations" $2,095,708.56, or 8.01 per cent., a total increase of $2,759,501.84, or 6.11 per cent.

This increase was in part the result of higher wage schedules, and increase in the average miles of railways operated and maintained of 382.07 miles, or 6.07 per cent., and in the mileage of locomotives in revenue service of 1,278,346 miles, or 3.70 per cent.

There were in service 27 gasoline motor cars. The mileage of these cars aggregated 626,980 miles, or 3.95 per cent. of the total revenue passenger train mileage and is included in the mileage statistics.

In the following statements the operating expenses, although distributed as provided for in the classification of the Interstate Commerce Commission, have been combined under comprehensive titles of accounts so as to present the year's expenses in a concise form:

Maintenance of Way and Structures.

	This Year.	Last Year.	Increase or Decrease.	Per Cent.
Average miles of railway operated and maintained —first and additional main tracks	7,298.30	6,800.46	497.84	7.32
Ballast	$61,327.57	$83,295.97	—$21,968.40	26.37
Ties	1,741,332.70	1,825,730.78	—84,398.08	4.62
Rails	245,218.70	280,674.92	—35,456.22	12.63
Frogs, switches and other track material	790,243.87	844,805.60	—54,561.73	6.46
Total material for roadway and track	$2,838,122.84	$3,034,507.27	—$196,384.43	6.47
Repairs of roadway and track	4,007,725.26	4,236,874.39	—229,149.13	5.41
Bridges, trestles, and culverts	980,787.10	448,674.58	532,112.52	118.60
Buildings, grounds and appurtenances	1,505,716.36	1,243,315.24	262,401.12	21.10
Snow and sand fences and snow sheds	17,980.46	16,345.65	1,634.81	10.00
Electric power, telegraph and telephone lines	119,525.38	97,348.51	22,176.87	22.78
Superintendence	630,933.73	583,232.41	47,701.32	8.19
Stationery and printing	36,122.25	29,223.37	6,898.88	23.61
Other expenses	58,955.26	35,169.23	23,786.03	67.63
Property abandoned	249,334.73	190,791.00	58,543.73	30.68
Total	$10,445,203.37	$9,915,481.65	$529,721.72	5.34
Cost per mile—all main tracks operated and maintained	$1,431.18	$1,458.06	—$26.88	1.84

The expenditures for bridges, trestles, and culverts include $176,423.45 for account of the new steel bridge over the Williamette River at Portland, Oregon, $244,114.97 for renewal of bridges over the Snake and the Kaw Rivers, and expenditures for the renewal of bridges in various other localities made necessary by the construction of second main track. The increase in expenses for buildings, grounds, and appurtenances resulted principally from expenditures amounting to $143,368.72 incurred in rearranging signals and interlocking plants in connection with construction of second main track.

	This Year.	Last Year.	+Increase. —Decrease.
Miles of new steel rails	287.24	268.90	+ 18.34
Per cent. of renewal of all rail in track, including sidings	3.01	3.09	— .08
Number of burnettized ties	1,336,463	1,453,287	—116,824
Number of other ties	907,266	741,219	+166,047
Total number of ties	2,243,729	2,194,506	+ 49,223
Equal to miles of continuous track	805.07	954.13	—149.06
Per cent. of renewal of all ties in track, including sidings	8.44	9.01	— .57
Number of tie plates	1,558,832	2,251,758	—692,926
Equal to miles of continuous track	279.66	402.10	—122.44
Number of continuous rail joints	179,598	153,089	+ 26,509
Equal to miles of continuous track	280.62	239.20	+ 41.42

The weight of rails per yard in main line and branches at the close of the year was as follows:

Miles of First and Additional Main Tracks Operated, and Maintained.	Total.	90 Lb.	85 Lb.	80 Lb.	75 Lb.	70 Lb.	67 Lb.	65 Lb.	62 Lb.	60 Lb.	56 Lb.	Less Than 56 Lb.
Main Line	4,425.26	1,621.28	32.60	1,479.49	639.71	550.60	.....	98.07	.....	3.21	.14	.16
Branches	3,037.88	21.26	1.41	32.31	350.37	656.59	29.52	2.78	22.56	1,121.36	588.71	211.01
Total	7,463.14	1,642.54	34.01	1,511.80	990.08	1,207.19	29.52	100.85	22.56	1,124.57	588.85	211.17
Per cent. of total miles of track	100.00	22.01	.45	20.25	13.27	16.18	.40	1.35	.30	15.07	7.89	2.83
Per cent. last year	100.00	17.50	.50	23.02	11.76	18.14	.44	.....	.33	16.44	8.54	3.33

Transportation Expenses.

	This Year.	Last Year.	Increase or Decrease.	Per Cent.
Locomotives, fuel for	$7,776,415.11	$7,084,790.58	$691,624.53	9.76
Locomotive service, other than fuel	5,207,384.40	4,805,010.50	402,373.90	8.37
Train service	3,895,415.09	3,650,239.34	245,175.75	6.72
Station and terminal service	4,694.578.08	4,397,029.15	297,548.93	6.77
Ferry and river service	14,056.97	.....	14,056.97	
Injuries, loss, damage, and other casualties	1,173,560.75	1,174,849.28	—1,288.53	11
Superintendence	994,193.71	880,857.76	113,335.95	12.87
Stationery and printing	198,757.34	186,185.93	12,571.41	6.75
Other expenses	36,973.65	29,298.97	7,674.68	26.19
Total	$23,991,335.10	$22,208,261.51	$1,783,073.59	8.03

The increase in these expenses resulted from the greater mileage run by locomotives in revenue service and from the higher prices paid for locomotive fuel.

The work done by the transportation department of the rail lines over that of last year is shown in the following table:

	Increase.	Decrease.	Per Cent.
Total operating revenues	.....	$1,304,494.06	1.47
Transportation expenses	$1,783,073.59	.....	8.03
Revenue passengers carried one mile	.....	26,732,284	2.78
Mileage of cars in passenger service	9,444,841	.....	9.92
Locomotive mileage with passenger and mixed trains, including helping	1,752,568	.....	11.04
Tons of commercial freight carried one mile	.....	193,431,548	3.23
Tons of commercial and company freight carried one mile	71,228,899	.....	.98
Mileage of cars in freight service	9,856,023	.....	2.23
Locomotive mileage with freight and mixed trains, including helping	.....	189,501	1.27
Total locomotive mileage in service for which the attendant expenses are charged to "Transportation Expenses".	1,278,246	.....	3.70

The average number of tons of freight per train, and loaded cars per train (excluding caboose), and the tons per loaded car for the respective companies for the year were:

Commercial and Company Freight (Way-Bill Tonnage).	*Tons per Train. Tons.	+Increase. —Decrease. Tons.	Per Cent.	Loaded Cars per Train. Cars.	+Increase. —Decrease. Cars.	Per Cent.	Per Cent. of Loaded Car Mileage to Total Car Mileage.	Tons per Loaded Car. Tons.	+Increase. —Decrease. Tons.	Per Cent.
Union Pacific R. R. Co.	561.35	+17.90	3.29	26.73	+.66	2.53	74.01—1.98	21.00	+.15	.72
Oregon Short Line R. R. Co.	598.57	+ 8.66	1.47	23.11	+.38	1.67	73.34— .50	25.90	—.05	.19
Oregon-Washington R. R. & Nav. Co.	491.01	—10.02	2.00	20.74	—.39	1.85	83.16+ .10	23.67	—.04	.17
Average, all lines	558.64	+10.75	1.96	25.02	+.36	1.46	74.93—1.37	22.33	+.11	.50

*Ton miles per revenue freight train and all mixed train miles.

The cost per locomotive mile run in revenue service and in non-revenue service for which the expenses are charged to "Transportation Expenses" was:

	This Year.	Last Year.	
For fuel for locomotives	21,64 cents.	20.45 cents.	+1.19 cents.
For all transportation expenses	66.79 cents.	64.15 cents.	+2.64 cents.

General Expenses.

	This Year.	Last Year.	Increase or Decrease.	Per Cent.
Salaries and expenses of general officers	$164,747.80	$194,902.42	—$30,154.62	15.47
Salaries and expenses of clerks and attendants	1,045,529.05	900,050.95	145,478.10	16.16
Law expenses	278,077.84	271,923.65	6,154.19	2.26
General office expenses	114,300.64	105,002.82	9,297.82	8.85
Stationery and printing	154,734.47	118,323.61	36,410.86	30.77
Insurance	170,767.19	160,169.18	10,598.01	6.62
Pensions	68,449.19	50,527.41	17,921.78	35.47
Other expenses	244,410.78	163,956.27	80,454.51	49.07
Total	$2,241,016.96	$1,964,856.31	$276,160.65	14.06

By order of the Board of Directors,

ROBERT S. LOVETT,

Chairman of the Executive Committee.

UNION PACIFIC RAILROAD AND AUXILIARY COMPANIES.
NO. 4—PROFIT AND LOSS FOR THE YEAR ENDED JUNE 30, 1911.

DEBITS.

Discount, commission, and expenses on bonds sold during the year	$2,995,734.25
Abandoned property not to be replaced	38,850.82
Cost of surveys and construction expenditures incurred in former years on lines subsequently abandoned now written off	713,908.66
Advances to Portland & Asiatic Steamship Co.	140,825.32
Miscellaneous payments	1,709.69
Premium on Utah & Northern Railway Co. bonds in sinking fund sold	6,365.37
Uncollectible accounts written off	38,044.55
Adjustments in accounts	37,250.46
Estimated liabilities for operating expenses and taxes of the Oregon Railroad & Navigation Co. not of record on date of sale of railways and property to the Oregon-Washington Railroad & Navigation Co.	523,266.17
Balance June 30, 1911	186,914,930.80
Total	$191,410,886.09

CREDITS.

Balance June 30, 1910		$115,796,646.87
Balance income from transportation operations (Table No. 2)	$4,601,702.91	
Balance income other than from transportation operations (Table No. 3)	9,732,742.63	14,334,445.54
Difference between $87,675 face value Union Pacific R. R. Co. Twenty Year Four Per Cent. Convertible Bonds retired and cancelled and $50,100 par value common stock issued in exchange therefor		37,575.00
Profit from sales of Northern Securities stock and stocks received in exchange therefor	$58,684,157.76	
Less: Amount taken up in Profit and Loss year ended June 30, 1905	4,955,479.30	53,728,678.46
Profit on sales of securities other than investment stocks		55,366.14
Sinking fund contributions and income from sinking fund investments		24,004.31
Interest on construction advances included in the cost of the railways purchased by the Oregon Short Line Railroad Co. and the Oregon-Washington Railroad & Navigation Co.		*3,426,734.83
Interest accruing prior to July 1, 1910, on other advances		150,467.02
Difference between proceeds from sale of property and amount charged on books		80,532.01
Proceeds from sale of unpledged lands and town lots		50,694.49
Liabilities written off		73,083.07
Old accounts collected		3,078.63
Expenditures by Oregon Railroad & Navigation Co. for additions, betterments and equipment since reorganization in 1898 to December 23, 1910, which were in former years charged to "Income Account", included in the purchase price of the property		3,649,579.72
Total		$191,410,886.09

*Interest as authorized in the "Classification of Expenditures for Road and Equipment" prescribed by the Interstate Commerce Commission, effective July 1, 1907.

UNION PACIFIC RAILROAD AND AUXILIARY COMPANIES.
NO. 5—ASSETS, JUNE 30, 1911.

(Excluding stocks and bonds owned by Auxiliary and Proprietary Companies and all offsetting accounts between them.)

	This Year.	Last Year.	Increase or Decrease.
Capital Assets.			
Cost of railways, equipment and appurtenances	*$478,844,052.15	$406,781,240.74	$72,062,811.41
Advances for construction and acquisition of new lines	8,131,040.03	36,870,601.98	—28,739,561.95
Terminal property and other lands	13,371,596.28	14,107,251.79	—735,655.51
Rolling stock	8,990,311.86	12,341,244.85	—3,350,932.99
Ocean steamships	6,191,862.92	6,132,890.48	58,972.44
	$515,528,863.24	$476,233,229.84	$39,295,633.40
Stocks and bonds as detailed in Tables Nos. 9, 10 and 11	259,831,250.01	208,561,011.65	51,270,238.36
Trust funds	266,105.34	261,862.44	4,242.90
	$775,626,218.59	$685,056,103.93	$90,570,114.66
Current Assets.			
Demand loans, Southern Pacific Co.	$20,007,305.41	$10,901,568.97	$9,105,736.44

Loans to San Pedro, Los Angeles & Salt Lake R. R. Co.	1,168,860.00	.....	1,168,860.00
Loans to Utah Light & Railway Co.	5,498,108.14	4,526,762.63	971,345.51
Cash	12,171,011.27	9,082,088.21	3,088,923.06
Demand loans and time deposits	28,900,000.00	27,450,000.00	1,450,000.00
Agents and conductors	582,529.43	1,042,116.17	—459,586.74
Traffic and car service	13,626.17	100,304.27	—86,678.10
Income accrued to June 30, on securities owned	4,625,691.00	4,939,580.50	—313,889.50
Individuals and companies	3,177,674.25	3,922,489.88	—744,815.63
U. S. Government transportation	502,725.82	403,059.61	99,666.21
Deposits against matured and called bonds	3,000.00	3,000.00	.....
Material, fuel and supplies	12,530,439.60	12,631,156.74	—100,717.14
	$89,180,971.09	$75,002,126.98	$14,178,844.11
Deferred Assets.			
Individuals and companies	$394,910.68	$78,087.27	$316,823.41
Contingent Assets.			
Unadjusted accounts	$790,235.72	$733,079.04	$57,156.68
Due from proprietary companies	1,043,942.23	1,311,747.00	—267,804.77
Land and town lot contracts	2,411,289.78	2,749,622.94	—338,333.16
	$4,245,467.73	$4,794,448.98	—$548,981.25
Total assets	$869,447,568.09	$764,930,767.16	$104,516,800.93

*The sum of $18,771,091.13 received to date from the Improvement and Equipment Fund and $13,310,236.52 appropriated from "Income Account," a total of $32,081,327.65 has been applied as a credit against this cost.

UNION PACIFIC RAILROAD AND AUXILIARY COMPANIES.
NO. 5.—LIABILITIES, JUNE 30, 1911.

(Excluding stocks and bonds owned by Auxiliary and Proprietary Companies and all offsetting accounts between them.)

LIABILITIES.	THIS YEAR.	LAST YEAR.	INCREASE OR DECREASE.
Capital Liabilities.			
Union Pacific Railroad Co.:			
Common stock	$216,627,800.00	$216,577,700.00	$50,100.00
Preferred stock	99,543,600.00	99,544,000.00	—400.00
Stocks of Auxiliary Companies in hands of the public, viz.:			
Oregon Railroad & Navigation Co.:			
Common stock	.....	20,100.00	—20,100.00
Preferred stock	.....	3,410.00	—3,410.00
Oregon-Washington Railroad and Navigation Co.:			
Capital stock	1,500.00	.....	1,500.00
Total stocks	$316,172,900.00	$316,145,210.00	$27,690.00
Funded debt (excluding bonds owned of Auxiliary and Proprietary Companies), Table No. 14	329,232,380.00	297,449,150.00	31,783,230.00
	$645,405,280.00	$613,594,360.00	$31,810,920.00
Current Liabilities.			
Coupons matured but not presented	$109,752.64	$152,767.74	—$43,015.10
Coupons due July 1	3,437,927.50	3,190,130.00	247,797.50
Interest accrued on bonds and loans to June 30	1,373,950.49	1,425,009.50	—51,059.01
Dividends due but uncalled for	45,797.50	43,176.50	2,621.00
Dividends payable July 1st and October 2nd	12,822,119.50	12,819,797.00	2,322.50
Mortgage bonds satisfied	3,000.00	3,000.00	.....
Vouchers and pay rolls	7,425,541.48	6,143,765.45	1,281,776.03
	$25,218,089.11	$23,777,646.19	$1,440,442.92
Deferred Liabilities.			
Taxes assessed but not due	$1,558,720.41	$1,347,919.09	$210,801.32
Hospital department	103,882.32	96,175.19	7,707.13
	$1,662,602.73	$1,444,094.28	$218,508.45
Contingent Liabilities.			
Insurance fund	$410,358.83	$410,670.16	—$311.33
Reserve for depreciation on steamships, on rolling stock leased to other companies, and on miscellaneous property	1,192,478.53	1,917,219.70	—724,741.17
Union Pacific Coal Co.	1,617,402.82	2,022,467.50	—405,064.68
Union Pacific Land Co.	.....	68,267.21	—68,267.21
Due to proprietary companies	3,942,802.66	3,149,772.31	793,030.35
Principal of deferred payments on land and town lot contracts	2,411,289.78	2,749,622.94	—338,333.16
Unadjusted accounts	672,332.83	.....	672,332.83
	$10,246,665.45	$10,318,019.82	—$71,354.37
Balance to credit of profit and loss (Table No. 4)	$186,914,930.80	$115,796,646.87	$71,118,283.93
Total liabilities	$869,447,568.09	$764,930,767.16	$104,516,800.93

UNION PACIFIC RAILROAD AND AUXILIARY COMPANIES.
NO. 6.—RECEIPTS AND EXPENDITURES FROM ALL SOURCES, YEAR ENDED JUNE 30, 1911.

EXPENDITURES.

Capital Expenditures.		
Extensions and branches	$5,686,400.71	
Balance of cost of properties acquired by Oregon Short Line and Oregon-Washington R. R. & Nav. Co.	18,026,117.48	
Additions and betterments	14,414,917.11	
Expenditures for construction and acquisition of new lines, terminal lands and property, and for rolling stock	3,864,620.61	
Advances for ocean steamships	58,972.44	
Miscellaneous improvements	4,744.73	
	$42,055,773.08	
Deduct for:		
Receipts from Improvement and Equipment Fund	$1,350,000.00	
Surveys and construction expenditures on lines subsequently abandoned, written off	641,050.25	
Abandoned property not to be replaced	165,487.11	
Transfers and adjustments in accounts	603,602.32	
	$2,760,139.68	
Increase in Assets.		$39,295,633.40
Stocks and bonds	$51,270,238.36	
Demand loans to Southern Pacific Co.	9,105,736.44	
Other demand loans and time deposits	3,590,205.51	
Cash	3,088,923.06	
Unadjusted accounts	57,156.68	
Total increase	$67,112,260.05	
Less decreases:		
Material, fuel and supplies	$100,717.14	
Due from proprietary companies	267,804.77	
Current cash accounts	1,184,237.45	
Total decrease	$1,552,759.36	
		65,559,500.69
Total		$104,855,134.09

RECEIPTS.

Capital Liabilities.		
U. P. R. R. Co. common stock issued in exchange for Twenty Year Four Per Cent. Convertible Bonds retired and cancelled	$50,100.00	
O. W. R. & N. Co. capital stock sold	1,500.00	
U. P. R. R. Co. First Lien and Refunding Four Per Cent. Bonds sold	7,275,000.00	
U. P. R. R. Co. First Lien and Refunding Four Per Cent. Sterling Bonds exchanged for Dollar Bonds	6,405.00	
O. W. R. & N. Co. First and Refunding Four Per Cent. Bonds sold	24,625,000.00	
	$31,958,005.00	
Deduct for:		
U. P. R. R. Co. preferred stock acquired	$400.00	
O. R. R. & N. Co. preferred stock retired	20,100.00	
O. R. R. & N. Co. common stock retired	3,410.00	
U. P. R. R. Co. Twenty Year Four Per Cent. Convertible Bonds retired and cancelled	87,675.00	
O. S. L. R. R. Co. Income "A" Bonds acquired	23,500.00	
O. S. L. R. R. Co. Income "B" Bonds acquired	12,000.00	
	$147,085.00	
Increase in Liabilities.		$31,810,920.00
Current cash accounts	$1,658,640.04	
Due to proprietary companies	319,698.46	
Contingent unadjusted accounts	672,332.83	
Total increase	$2,650,671.33	
Less decrease:		
Reserve for depreciation on steamships, equipment, and miscellaneous property	724,741.17	
Profit and Loss.		1,925,930.16
Gross operating revenues	$88,983,107.81	
Interest, dividends and other income	22,449,046.38	
	$111,432,154.19	
Profit on Northern Securities stocks	53,728,678.46	
Expenditures for additions, betterments and equipment charged to "Income Account" in former years	3,649,579.72	
Difference between $87,675 face value Union Pacific R. R. Co. Twenty Year Four Per Cent. Convertible Bonds retired and cancelled and $50,100 par value common stock issued in exchange therefor	37,575.00	
Miscellaneous receipts	73,083.07	
Total receipts	$168,921,070.44	
Deduct for:		
Operating expenses	$49,807,833.99	
Taxes	3,464,147.20	
Interest on funded debt and other charges	14,393,534.52	
Dividends on preferred and common stocks	25,641,315.51	
Discount, commission and expenses on bonds sold	2,995,734.25	
Miscellaneous expenses and charges	1,500,221.04	
Total expenditures	$97,802,786.51	
		71,118,283.93
Total		$104,855,134.09

UNION PACIFIC RAILROAD AND AUXILIARY COMPANIES.
NO. 9.—STOCKS OWNED OF OTHER COMPANIES, JUNE 30, 1911.

COMPANY.	TOTAL OUTSTANDING JUNE 30, 1911.	TOTAL OWNED BY THE UNION PACIEIC RAILROAD AND AUXILIARY.	+INCREASE. —DECREASE. DURING YEAR.
Camas Prairie Railroad	$20,000.00	$10,000.00	.....
Central Idaho Railroad (a)	220,000.00	220,000.00	+ $198,000.00
Green River Water Works	225,000.00	225,000.00	.....
Ilwaco Railroad	.....	.....	—(b) 315,000.00
Kansas City Terminal Railway	1,000,000.00	100,000.00	.....
Leavenworth & Topeka Railway	50,000.00	25,000.00	.....
Leavenworth Depot & Railroad	150,000.00	50,000.00	.....
McKeen Motor Car	1,000,000.00	550,000.00	+ 550,000.00
Ogden Union Railway & Depot	300,000.00	150,000.00	.....
Oregon & Washington Railroad	1,000,000.00	999,300.00	.....
Pacific Fruit Express (c)	10,800,000.00	5,400,000.00	.....
Rattlesnake Creek Water	78,300.00	78,300.00	.....

Riverside Homestead	100,000.00	100,000.00		
St. Joseph & Grand Island. Railroad:				
Common	4,600,000.00	3,956,400.00	+	875,900.00
First Preferred	5,500,000.00	2,429,340.00	+	1,014,240.00
Second Preferred	3,500,000.00	2,719,100.00	+	904,100.00
Salt Lake & Idaho Railroad. (a)	160,000.00	160,000.00	+	144,000.00
San Francisco & Portland Steamship	500,000.00	500,000.00		
San Pedro, Los Angeles & Salt Lake Railroad	25,000,000.00	12,500,000.00		
Short Line Land & Improvement	100,000.00	50,000.00		
Topeka Iron	110,000.00	55,000.00		
Union Depot & Railway (Denver)	400,000.00	240,000.00		
Union Depot (Kansas City).			—	45,000.00
Union Land	10,000.00	10,000.00		
Union Pacific Coal	5,000,000.00	5,000,000.00		
Union Pacific Equipment Association	100,000.00	100,000.00		
Union Pacific Land	100,000.00	100,000.00		
Union Pacific Water	500.00	500.00		
Utah Light & Railway:				
Common	2,052,250.00	1,852,350.00	+	2,825.00
Preferred	3,996,500.00	3,842,875.00	+	2,000.00
Yakima Valley Transportation	500,000.00	499,700.00	+	499,700.00
Total, 1911		$41,922,865.00	+	$3,830,765.00
Total, 1910		38,092,100.00		

(a) 10 per cent. paid. (b) Retired by sale of property to Oregon-Washington Railroad & Navigation Company. (c) $5,400,000 owned by Southern Pacific Company.

Of the total $41,922,865.00 owned in 1911, $99,400.00 Union Pacific land stocks were pledged and the remainder unpledged. Of the total $38,092,100.00 owned in 1910, $99,400.00 were pledged and the remainder unpledged.

UNION PACIFIC RAILROAD AND AUXILIARY COMPANIES.
NO. 10.—INVESTMENT STOCKS OWNED, JUNE 30, 1911.

COMPANY.	Total Par Value Owned by the Union Pacific R. R. Co. and the Oregon Short Line R. R. Co.	Increase or Decrease During Year.	Deposited Under Oregon Short Line Refunding Mortgage. (a)
Baltimore & Ohio Railroad.			
Common Stock	$32,334,200.00		$10,255,400.00
Preferred Stock	7,206,400.00		7,206,400.00
Chicago & Alton Railroad.			
Preferred Stock	10,343,100.00		
Chicago & Northwestern Railway.			
Common Stock	4,018,700.00	—$50.00	
Chicago, Mil. & St. Paul Ry.			
Preferred Stock	1,845,000.00		
Illinois Central Railroad.			
Capital Stock	22,500,000.00		
New York Cent. & H. R. R. R.			
Capital Stock	17,857,100.00		8,000,000.00
Northern Securities.			
Stubs	724,900.00		
Railroad Securities.			
Common Stock	3,484,420.00	$1,020.00	
Preferred Stock	1,936,400.00	500.00	
Southern Pacific.			
Common Stock	126,650,000.00		108,000,000.00
Total, 1911	$228,900,220.00	$1,520.00 —50.00	$133,461,800.00

(a) Of the total $100,000,000 of bonds outstanding under this mortgage, $55,000,000 are a free asset in the treasury of the Union Pacific Railroad Co.

UNION PACIFIC RAILROAD AND AUXILIARY COMPANIES.
NO. 11.—BONDS OWNED BY OTHER COMPANIES, JUNE 30, 1911.

COMPANY.	Total Outstanding June 30, 1911.	Total Owned by the Union Pacific Railroad and Auxiliary Companies.	+Increase. —Decrease. During Year.
Atch. Union Depot & R. R. Second Mortgage 5%	$31,500.00	$4,500.00	
Cheyenne County, Colorado. Refunding 5%		26,200.00	
Green River Water Works. First Mortgage 6%	194,000.00	194,000.00 —	$4,000.00
Idaho Northern Railroad. First Mortgage 5%		—(b)	875,000.00
Second Mortgage 5%		—(b)	160,000.00
Ilwaco Railroad. First Mortgage 6%		—(b)	305,000.00
Leavenwodth & Topeka Ry. First Mortgage 4%	250,000.00	125,000.00	
Leavenworth Depot and R. R. First Mortgage 5%	150,000.00	63,000.00	
Northern Pacific Terminal. First Mortgage 6%	3,416,000.00	217,000.00 +	43,000.00
Ogden Union Ry. and Depot. First Mortgage 5%	326,000.00	163,000.00	
Oregon, Wash. & Idaho R. R. First Mortgage 6%		—(b)	3,000,000.00
Payette Valley Railroad. First Mortgage 5%	44,000.00	44,000.00	
Payette Valley Exten. R. R. First Mortgage 5%	140,000.00	140,000.00 +	140,000.00
Rattlesnake Creek Water. First Mortgage 6%	146,000.00	146,000.00	
San Pedro, Los Angeles & Salt Lake Railroad. First Mortgage 4%	48,835,000.00	24,417,000.00 +	974,000.00
Sharon Springs Township. Railroad Aid 5%	15,000.00	15,000.00 +	15,000.00
Southern Pacific. 4% Twenty-Year Convertible	81,151,000.00	927,000.00	
4½% Twenty-Year Gold	227,000.00	66,000.00 +	1,000.00
Utah Light & Power. Consolidated Mortgage 4%	1,115,000.00	2,000.00	
Utah Light & Railway. Consolidated Mortgage 5%	1,485,000.00	993,000.00	
Collateral Trust 6%	175,000.00	5,000.00 —	36,000.00
Union Pacific Coal. First Mortgage 5%	(a) 5,000,000.00	3,354,000.00 —	153,000.00
Union Pacific Land. First Mortgage 4%	5,381,840.00	5,381,840.00 —	464,160.00
Total, 1911		$36,283,540.00 —	$3,824,160.00
Total, 1910		40,107,700.00	

(a) $1,646,000 held by Union Pacific Coal Co. sinking fund. (b) Retired by sale of property to Oregon-Washington Railroad & Navigation Co.

Note.—Of the total $36,283,540.00 owned in 1911, $23,443,000.00 San Pedro, Los Angeles & Salt Lake first mortgage 4 per cent. bonds and $5,381,840.00 Union Pacific land first mortgage 4 per cent. bonds were pledged and the remaining bonds were unpledged. In 1910, of the total $40,107,700.00, $5,846,000.00 were pledged and the remainder were unpledged.

UNION PACIFIC RAILROAD AND AUXILIARY COMPANIES.
NO. 27.—GENERAL OPERATING RESULTS, YEAR ENDED JUNE 30, 1911.

	This Year.	Last Year.	Increase or Decrease.	Per Cent.
Av. mls. of way operated	6,678.29	6,296.22	382.07	6.07
REV. AND EXPENSES.				
(Rail Lines and Outside Operations.)				
Gross revenues	$88,983,107.81	$90,228,092.20	—$1,244,984.39	1.38
Gross expenses	49,807,833.99	46,938,909.34	2,868,924.65	6.11
Revenues over expenses.	39,175,273.82	43,289,182.86	—4,113,909.04	9.50
Ratio of exp. to gross rev.	55.97	52.02	3.95	7.59
(Rail Lines Only.)				
Total operating revenues.	87,201,971.38	88,506,465.44	—1,304,494.06	1.47
Operating expenses	47,907,772.31	45,148,270.47	2,759,501.84	6.11
Net operating revenue	39,294,199.07	43,358,194.97	—4,063,995.90	9.37
Ratio op. exp. to tl. op. rev.	54.94	51.01	3.93	7.70
Op. rev. per mile of road	13,057.53	14,057.08	—999.55	7.11
Op. exp. per mile of road	7,173.66	7,170.69	2.97	.04
Net op. rev. per m. of rd.	5,883.87	6,886.39	—1,002.52	14.57
Op. rev. per *rev. t.* m.(a)	3.00	3.21	—.21	6.54
Op. exp. per *rev. t.* m.(a)	1.65	1.64	.01	.61
Net op. rev. per *rev.t.*m.(a)	1.35	1.57	—.22	14.01
TRAIN MILES.				
Freight trains—revenue	11,719,366	11,995,708	—276,342	2.30
Pass. trains—revenue	15,259,338	13,737,766	1,521,572	11.08
Mixed trains—revenue	1,432,242	1,283,930	148,312	11.55
Special trains—revenue	23,081	63,225	—40,144	63.49
Total train miles—loco.	28,434,027	27,080,629	1,353,398	5.00
Motor cars—revenue	626,980	522,395	104,585	20.02
Tl. t. m. in rev. service.	29,061,007	27,603,024	1,457,983	5.28
LOCOMOTIVE MILES.				
Frt.—rev., light and help.	13,252,088	13,594,954	—342,866	2.52
Pas.—rev., l. and help.(b)	16,158,511	14,559,308	1,599,203	10.98
Mixed—rev., l. and help.	1,469,841	1,316,476	153,365	11.65
Special—rev., l. and help.	30,969	76,490	—45,521	59.51
Total *traffic* miles	30,911,409	29,547,228	1,364,181	4.62
Switching	4,331,630	4,405,689	—74,059	1.68
Tl. m. in rev. service (b)	35,243,039	33,952,917	1,290,122	3.80
Mls. in non-rev. serv.—included in "Trans. Exp."	537,665	549,541	—11,876	2.16
M. in other non-rev. serv.	1,228,945	1,111,700	117,245	10.55
Total locomotive miles(b)	37,009,649	35,614,158	1,395,491	3.92
CAR MILES.				
Frt. cars, loaded—revenue	329,078,939	327,436,361	1,642,578	.50
Frt. cars, empty—revenue	110,125,338	101,689,023	8,436,315	8.30
Caboose—revenue	11,768,231	11,991,101	—222,870	1.86
Tl. frt. car and cab.—rev.	450,972,508	441,116,485	9,856,023	2.23
Tl. f. c, and cab.—non-rev.	650,482	424,372	226,110	53.28
Tl. frt. car and caboose.	451,622,990	441,540,857	10,082,133	2.28
Passenger cars—revenue.	103,683,015	94,337,752	9,345,263	9.91
Motor cars and tr.—rev.	954,330	854,752	99,578	11.65
Total pass. cars—rev. (c)	104,637,345	95,192,504	9,444,841	9.92
Tl. pass. cars—non-rev.	237,038	198,397	38,641	19.48
Spl. cars—frt. & cab.—rev.	315,406	350,334	—34,928	9.98
Special cars—pass.—rev.	88,399	475,346	—386,947	81.40
Total special cars	403,805	825,680	—421,875	51.09
Av. No. loaded frt. cars in frt. tr.—East or North.	25.29	24.46	.83	3.39
Av. No. loaded frt. cars in frt. tr.—West or South	24.75	24.85	—.10	.40
Av. No. loaded frt. cars in freight trains	25.02	24.66	.36	1.46
Av. No. ld. and emp. frt. c. in frt. tr. (excl. caboose)	33.40	32.31	1.09	3.37
Ratio of ld. frt. car mlge. to total frt. car mlge.(d)	74.93	76.30	—1.37	1.80
Ratio of emp. frt. c. mlge. to total frt. car mlge.(d)	25.07	23.70	1.37	5.78
Av. No. cars in pass. tr.	6.00	6.12	—.12	1.96
MISCELLANEOUS.				
Av. cost of m. of w. & str. per mile of main tracks	$1,431.18	$1,458.06	—$26.88	1.84
Av. cost of rep. & replace. per loco. per annum	3,712.32	3,656.45	55.87	1.53
Av. cost of rep. & replace. per pas. tr. car per an.	1,045.78	1,286.66	—240.88	18.72
Av. cost of rep. & replace. per frt. tr. car per an.	107.95	121.68	—13.73	11.28
Trans. exp. per tl. *train mile* in rev. service.(a)	82.55 cents	80.46 cents	2.09 cents	2.60
Trans. exp. per *loco. mile* incl. in "Trans. Exp."	66.79 cents	64.15 cents	2.64 cents	4.12

(a) Based on "total train miles in revenue service. (b) Excluding miles run by motor cars. (c) Includes mileage of passenger-train cars in all trains. (d) Excludes non-revenue and caboose mileage.